NCFM

NSE's CERTIFICATION IN FINANCIAL MARKETS

Investment Analysis and Portfolio Management Module

NATIONAL STOCK EXCHANGE OF INDIA LIMITED

Test Details

Sr. No.	Name of Module	Fees (Rs.)	Test Duration (in minutes)	No. of Questions	Maximum Marks	Pass Marks (%)	Certificate Validity (in years)
1	Financial Markets:A Beginners' Module	1500	120	60	100	50	5
2	Mutual Funds : A Beginners' Module	1500	120	60	100	50	5
3	Currency Derivatives: A Beginner's Module ###	750	60	50	100	50	5
4	Equity Derivatives: A Beginner's Module ###	750	60	50	100	50	5
5	Interest Rate Derivatives: A Beginner's Module	1500	120	60	100	50	5
6	Securities Market (Basic) Module	1500	105	60	100	60	5
7	Capital Market (Dealers) Module *	1500	105	60	100	50	5
8	Derivatives Market (Dealers) Module **	1500	120	60	100	60	3
9	FIMMDA-NSE Debt Market (Basic) Module	1500	120	60	100	60	5
10	Investment Analysis and Portfolio Management Module	1500	120	60	100	60	5
11	NISM-Series-I: Currency Derivatives Certification Examination	1000	120	60	100	60	3
12	NISM-Series-II-A: Registrars to an Issue and Share Transfer Agents - Corporate Certification Examination	1000	120	100	100	50	3
13	NISM-Series-II-B: Registrars to an Issue and Share Transfer Agents - Mutual Fund Certification Examination	1000	120	100	100	50	3
14	NSDL-Depository Operations Module	1500	75	60	100	60 #	5
15	Commodities Market Module	1800	120	60	100	50	3
16	AMFI-Mutual Fund (Basic) Module	1000	90	62	100	50	No limit
17	AMFI-Mutual Fund (Advisors) Module ##	1000	120	72	100	50	5
18	Surveillance in Stock Exchanges Module	1500	120	50	100	60	5
19	Corporate Governance Module	1500	90	100	100	60	5
20	Compliance Officers (Brokers) Module	1500	120	60	100	60	5
21	Compliance Officers (Corporates) Module	1500	120	60	100	60	5
22	Information Security Auditors Module (Part-1)	2250	120	90	100	60	2
	Information Security Auditors Module (Part-2)	2250	120	90	100	60	
23	FPSB India Exam 1 to 4***	2000 per exam	120	75	140	60	NA
24	Options Trading Strategies Module	1500	120	60	100	60	5

***** Candidates have the option to take the CMDM test in English, Gujarati or Hindi language. The workbook for the module is presently available in ENGLISH.

****** Candidates have the option to take the DMDM test in English, Gujarati or Hindi language. The workbook for the module is also available in ENGLISH, GUJARATI and HINDI languages.

Candidates securing 80% or more marks in NSDL-Depository Operations Module ONLY will be certified as 'Trainers'.

Candidates have the option to take the AMFI (Adv) test in English, Gujarati or Hindi languages. The workbook for the module, which is available for a fee at AMFI, remains in ENGLISH.

Revision in test fees and test parameters with effect from April 01, 2010. Please refer to circular NSE/NCFM/ 13815 dated 01-Jan-2010 for details.

******* Modules of Financial Planning Standards Board India (Certified Financial Planner Certification) i.e. (i) Risk Analysis & Insurance Planning (ii) Retirement Planning & Employee Benefits (iii) Investment Planning and (iv) Tax Planning & Estate Planning.

The curriculum for each of the module (except FPSB India Exam 1 to 4) is available on our website: www.nseindia.com > NCFM > Curriculum & Study Material.

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Distribution of weights in the

Investment Analysis and Portfolio Management Module Curriculum

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Note: Candidates are advised to refer to NSE's website: www.nseindia.com, click on 'NCFM' link and then go to 'Announcements' link, regarding revisions/updations in NCFM modules or launch of new modules, if any.

CHAPTER 1 : Objectives of Investment Decisions

1.1 Introduction

In an economy, people indulge in economic activity to support their consumption requirements. Savings arise from deferred consumption, to be invested, in anticipation of future returns. Investments could be made into financial assets, like stocks, bonds, and similar instruments or into real assets, like houses, land, or commodities.

Our aim in this book is to provide a brief overview of three aspects of investment: the various options available to an investor in financial instruments, the tools used in modern finance to optimally manage the financial portfolio and lastly the professional asset management industry as it exists today.

Returns more often than not differ across their risk profiles, generally rising with the expected risk, i.e., higher the returns, higher the risk. The underlying objective of portfolio management is therefore to create a balance between the trade-off of returns and risk across multiple asset classes. Portfolio management is the art of managing the expected return requirement for the corresponding risk tolerance. Simply put, a good portfolio manager's objective is to maximize the return subject to the risk-tolerance level or to achieve a pre-specified level of return with minimum risk.

In our first chapter, we start with the various types of investors in the markets today, their return requirements and the various constraints that an investor faces.

1.2 Types of investors

There is wide diversity among investors, depending on their investment styles, mandates, horizons, and assets under management. Primarily, investors are either individuals, in that they invest for themselves or institutions, where they invest on behalf of others. Risk appetites and return requirements greatly vary across investor classes and are key determinants of the investing styles and strategies followed as also the constraints faced. A quick look at the broad groups of investors in the market illustrates the point.

1.2.1 *Individuals*

While in terms of numbers, individuals comprise the single largest group in most markets, the size of the portfolio of each investor is usually quite small. Individuals differ across their risk appetite and return requirements. Those averse to risk in their portfolios would be inclined towards safe investments like Government securities and bank deposits, while others may be risk takers who would like to invest and / or speculate in the equity markets. Requirements of individuals also evolve according to their life-cycle positioning. For example, in India, an individual

in the 25-35 years age group may plan for purchase of a house and vehicle, an individual belonging to the age group of 35-45 years may plan for children's education and children's marriage, an individual in his or her fifties would be planning for post-retirement life. The investment portfolio then changes depending on the capital needed for these requirements.

1.2.2 *Institutions*

Institutional investors comprise the largest active group in the financial markets. As mentioned earlier, institutions are representative organizations, i.e., they invest capital on behalf of others, like individuals or other institutions. Assets under management are generally large and managed professionally by fund managers. Examples of such organizations are mutual funds, pension funds, insurance companies, hedge funds, endowment funds, banks, private equity and venture capital firms and other financial institutions. We briefly describe some of them here.

Box No. 1.1:
The Indian financial markets are also witnessing active participation by institutions with foreign institutional investors, domestic mutual funds, and domestic insurance companies comprising the three major groups, owning more than a third of the shareholding in listed companies, with the Government and promoters another 50%. Over the years the share of institutions has risen in share ownership of companies.

1.2.2.1 *Mutual funds*

Individuals are usually constrained either by resources or by limits to their knowledge of the investment outlook of various financial assets (or both) and the difficulty of keeping abreast of changes taking place in a rapidly changing economic environment. Given the small portfolio size to manage, it may not be optimal for an individual to spend his or her time analyzing various possible investment strategies and devise investment plans and strategies accordingly. Instead, they could rely on professionals who possess the necessary expertise to manage thier funds within a broad, pre-specified plan. Mutual funds pool investors' money and invest according to pre-specified, broad parameters. These funds are managed and operated by professionals whose remunerations are linked to the performance of the funds. The profit or capital gain from the funds, after paying the management fees and commission is distributed among the individual investors in proportion to their holdings in the fund. Mutual funds vary greatly, depending on their investment objectives, the set of asset classes they invest in, and the overall strategy they adopt towards investments.

1.2.2.2 *Pension funds*

Pension funds are created (either by employers or employee unions) to manage the retirement funds of the employees of companies or the Government. Funds are contributed by the employers and employees during the working life of the employees and the objective is to provide benefits

to the employees post their retirement. The management of pension funds may be in-house or through some financial intermediary. Pension funds of large organizations are usually very large and form a substantial investor group for various financial instruments.

1.2.2.3 *Endowment funds*

Endowment funds are generally non-profit organizations that manage funds to generate a steady return to help them fulfill their investment objectives. Endowment funds are usually initiated by a non-refundable capital contribution. The contributor generally specifies the purpose (specific or general) and appoints trustees to manage the funds. Such funds are usually managed by charitable organizations, educational organization, non-Government organizations, etc. The investment policy of endowment funds needs to be approved by the trustees of the funds.

1.2.2.4 *Insurance companies (Life and Non-life)*

Insurance companies, both life and non-life, hold large portfolios from premiums contributed by policyholders to policies that these companies underwrite. There are many different kinds of insurance polices and the premiums differ accordingly. For example, unlike term insurance, assurance or endowment policies ensure a return of capital to the policyholder on maturity, along with the death benefits. The premium for such poliices may be higher than term policies. The investment strategy of insurance companies depends on actuarial estimates of timing and amount of future claims. Insurance companies are generally conservative in their attitude towards risks and their asset investments are geared towards meeting current cash flow needs as well as meeting perceived future liabilities.

1.2.2.5 *Banks*

Assets of banks consist mainly of loans to businesses and consumers and their liabilities comprise of various forms of deposits from consumers. Their main source of income is from what is called as the interest rate spread, which is the difference between the lending rate (rate at which banks earn) and the deposit rate (rate at which banks pay). Banks generally do not lend 100% of their deposits. They are statutorily required to maintain a certain portion of the deposits as cash and another portion in the form of liquid and safe assets (generally Government securities), which yield a lower rate of return. These requirements, known as the Cash Reserve Ratio (CRR ratio) and Statutory Liquidity Ratio (SLR ratio) in India, are stipulated by the Reserve Bank of India and banks need to adhere to them.

In addition to the broad categories mentioned above, investors in the markets are also classified based on the objectives with which they trade. Under this classification, there are hedgers, speculators and arbitrageurs. Hedgers invest to provide a cover for risks on a portfolio they already hold, speculators take additional risks to earn supernormal returns and arbitrageurs take simultaneous positions (say in two equivalent assets or same asset in two different

markets etc.) to earn riskless profits arising out of the price differential if they exist.

Another category of investors include day-traders who trade in order to profit from intra-day price changes. They generally take a position at the beginning of the trading session and square off their position later during the day, ensuring that they do not carry any open position to the next trading day. Traders in the markets not only invest directly in securities in the so-called cash markets, they also invest in derivatives, instruments that derive their value from the underlying securities.

1.3 Constraints

Portfolio management is usually a constrained optimization exercise: Every investor has some constraint (limits) within which she wants the portfolio to lie, typical examples being the risk profile, the time horizon, the choice of securities, optimal use of tax rules etc. The professional portfolio advisor or manager also needs to consider the constraint set of the investors while designing the portfolio; besides having some constraints of his or her own, like liquidity, market risk, cash levels mandated across certain asset classes etc.

We provide a quick outline of the various constraints and limitations that are faced by the broad categories of investors mentioned above.

1.3.1 Liquidity

In investment decisions, liquidity refers to the marketability of the asset, i.e., the ability and ease of an asset to be converted into cash and vice versa. It is generally measured across two different parameters, viz., (i) market breadth, which measures the cost of transacting a given volume of the security, this is also referred to as the impact cost; and (ii) market depth, which measures the units that can be traded for a given price impact, simply put, the size of the transaction needed to bring about a unit change in the price. Adequate liquidity is usually characterized by high levels of trading activity. High demand and supply of the security would generally result in low impact costs of trading and reduce liquidity risk.

1.3.2 Investment horizons

The investment horizon refers to the length of time for which an investor expects to remain invested in a particular security or portfolio, before realizing the returns. Knowing the investment horizon helps in security selection in that it gives an idea about investors' income needs and desired risk exposure. In general, investors with shorter investment horizons prefer assets with low risk, like fixed-income securities, whereas for longer investment horizons investors look at riskier assets like equities. Risk-adjusted returns for equity are generally found to be higher for longer investment horizon, but lower in case of short investment horizons, largely due to the high volatility in the equity markets. Further, certain securities require commitment

to invest for a certain minimum investment period, for example in India, the Post Office savings or Government small-saving schemes like the National Savings Certificate (NSC) have a minimum maturity of 3-6 years.

Investment horizon also facilitates in making a decision between investing in a liquid or relatively illiquid investment. If an investor wants to invest for a longer period, liquidity costs may not be a significant factor, whereas if the investment horizon is a short period (say 1 month) then the impact cost (liquidity) becomes significant as it could form a meaningful component of the expected return.

1.3.3 Taxation

The investment decision is also affected by the taxation laws of the land. Investors are always concerned with the net and not gross returns and therefore tax-free investments or investments subject to lower tax rate may trade at a premium as compared to investments with taxable returns. The following example will give a better understanding of the concept:

Table 1.1:

Asset	Type	Expected Return	Net Return
A	10% taxable bonds (30% tax)	10%	10%*(1-0.3) = 7%
B	8% tax-free bonds	8%	8%

Although asset A carries a higher coupon rate, the net return for the investors would be higher for asset B and hence asset B would trade at a premium as compared to asset A. In some cases taxation benefits on certain types of income are available on specific investments. Such taxation benefits should also be considered before deciding the investment portfolio.

1.4 Goals of Investors

There are specific needs for all types of investors. For individual investors, retirement, children's marriage / education, housing etc. are major event triggers that cause an increase in the demands for funds. An investment decision will depend on the investor's plans for the above needs. Similarly, there are certain specific needs for institutional investors also. For example, for a pension fund the investment policy will depend on the average age of the plan's participants.

In addition to the few mentioned here, there are other constraints like the level of requisite knowledge (investors may not be aware of certain financial instruments and their pricing), investment size (e.g., small investors may not be able to invest in Certificate of Deposits), regulatory provisions (country may impose restriction on investments in foreign countries) etc. which also serve to outline the investment choices faced by investors.

CHAPTER 2: Financial Markets

2.1 Introduction

There are a wide range of financial securities available in the markets these days. In this chapter, we take a look at different financial markets and try to explain the various instruments where investors can potentially park their funds.

Financial markets can mainly be classified into money markets and capital markets. Instruments in the money markets include mainly short-term, marketable, liquid, low-risk debt securities. Capital markets, in contrast, include longer-term and riskier securities, which include bonds and equities. There is also a wide range of derivatives instruments that are traded in the capital markets.

Both bond market and money market instruments are fixed-income securities but bond market instruments are generally of longer maturity period as compared to money market instruments. Money market instruments are of very short maturity period. The equities market can be further classified into the primary and the secondary market. Derivative market instruments are mainly futures, forwards and options on the underlying instruments, usually equities and bonds.

2.2 Primary and Secondary Markets

A primary market is that segment of the capital market, which deals with the raising of capital from investors via issuance of new securities. New stocks/bonds are sold by the issuer to the public in the primary market. When a particular security is offered to the public for the first time, it is called an Initial Public Offering (IPO). When an issuer wants to issue more securities of a category that is already in existence in the market it is referred to as Follow-up Offerings.

Example: Reliance Power Ltd.'s offer in 2008 was an IPO because it was for the first time that Reliance Power Ltd. offered securities to the public. Whereas, BEML's public offer in 2007 was a Follow-up Offering as BEML shares were already issued to the public before 2007 and were available in the secondary market.

It is generally easier to price a security during a Follow-up Offering since the market price of the security is actually available before the company comes up with the offer, whereas in the case of an IPO it is very difficult to price the offer since there is no prevailing market for the security. It is in the interest of the company to estimate the correct price of the offer, since there is a risk of failure of the issue in case of non-subscription if the offer is overpriced. If the issue is underpriced, the company stands to lose notionally since the securities will be sold at a price lower than its intrinsic value, resulting in lower realizations.

The secondary market (also known as 'aftermarket') is the financial market where securities, which have been issued before are traded. The secondary market helps in bringing potential buyers and sellers for a particular security together and helps in facilitating the transfer of the security between the parties. Unlike in the primary market where the funds move from the hands of the investors to the issuer (company/ Government, etc.), in case of the secondary market, funds and the securities are transferred from the hands of one investor to the hands of another. Thus the primary market facilitates capital formation in the economy and secondary market provides liquidity to the securities.

There is another market place, which is widely referred to as the third market in the investment world. It is called the over-the-counter market or OTC market. The OTC market refers to all transactions in securities that are not undertaken on an Exchange. Securities traded on an OTC market may or may not be traded on a recognized stock exchange. Trading in the OTC market is generally open to all registered broker-dealers. There may be regulatory restrictions on trading some products in the OTC markets. For example, in India equity derivatives is one of the products which is regulatorily not allowed to be traded in the OTC markets. In addition to these three, direct transactions between institutional investors, undertaken primarily with transaction costs in mind, are referred to as the fourth market.

2.3 Trading in Secondary Markets

Trading in secondary market happens through placing of orders by the investors and their matching with a counter order in the trading system. Orders refer to instructions provided by a customer to a brokerage firm, for buying or selling a security with specific conditions. These conditions may be related to the price of the security (limit order or market order or stop loss orders) or related to time (a day order or immediate or cancel order). Advances in technology have led to most secondary markets of the world becoming electronic exchanges. Disaggregated traders across regions simply log in the exchange, and use their trading terminals to key in orders for transaction in securities. We outline some of the most popular orders below:

2.3.1 *Types of Orders*

Limit Price / Order: **In these orders, the price for the order has to be specified while entering the order into the system. The order gets executed only at the quoted price or at a better price (a price lower than the limit price in case of a purchase order and a price higher than the limit price in case of a sale order).**

Market Price / Order: **Here the constraint is the time of execution and not the price. It gets executed at the best price obtainable at the time of entering the order. The system immediately executes the order, if there is a pending order of the opposite type against which the order can match. The matching is done automatically at the best available price (which is called as the**

market price). If it is a sale order, the order is matched against the best bid (buy) price and if it is a purchase order, the order is matched against the best ask (sell) price. The best bid price is the order with the highest buy price and the best ask price is the order with the lowest sell price.

Stop Loss (SL) Price/Order: **Stop-loss orders which are entered into the trading system, get activated only when the market price of the relevant security reaches a threshold price. When the market reaches the threshold or pre-determined price, the stop loss order is triggered and enters into the system as a market/limit order and is executed at the market price / limit order price or better price. Until the threshold price is reached in the market the stop loss order does not enter the market and continues to remain in the order book. A sell order in the stop loss book gets triggered when the last traded price in the normal market reaches or falls below the trigger price of the order. A buy order in the stop loss book gets triggered when the last traded price in the normal market reaches or exceeds the trigger price of the order. The trigger price should be less than the limit price in case of a purchase order and vice versa.**

Time Related Conditions

Day Order (Day): **A Day order is valid for the day on which it is entered. The order, if not matched, gets cancelled automatically at the end of the trading day. At the National Stock Exchange (NSE) all orders are Day orders. That is the orders are matched during the day and all unmatched orders are flushed out of the system at the end of the trading day.**

Immediate or Cancel order (IOC): **An IOC order allows the investor to buy or sell a security as soon as the order is released into the market, failing which the order is removed from the system. Partial match is possible for the order and the unmatched portion of the order is cancelled immediately.**

2.3.2 *Matching of orders*

When the orders are received, they are time-stamped and then immediately processed for potential match. The best buy order is then matched with the best sell order. For this purpose, the best buy order is the one with highest price offered, also called the highest bid, and the best sell order is the one with lowest price also called the lowest ask (i.e., orders are looked at from the point of view of the opposite party). If a match is found then the order is executed and a trade happens. An order can also be executed against multiple pending orders, which will result in more than one trade per order. If an order cannot be matched with pending orders, the order is stored in the pending orders book till a match is found or till the end of the day whichever is earlier. The matching of orders at NSE is done on a price-time priority i.e., in the following sequence:

- **Best Price**
- **Within Price, by time priority**

Orders lying unmatched in the trading system are 'passive' orders and orders that come in to match the existing orders are called 'active' orders. Orders are always matched at the passive order price. Given their nature, market orders are instantly executed, as compared to limit orders, which remain in the trading system until their market prices are reached. The set of such orders across stocks at any point in time in the exchange, is called the Limit Order Book (LOB) of the exchange. The top five bids/asks (limit orders all) for any security are usually visible to market participants and constitute the Market By Price (MBP) of the security.

2.4 The Money Market

The money market is a subset of the fixed-income market. In the money market, participants borrow or lend for short period of time, usually up to a period of one year. These instruments are generally traded by the Government, financial institutions and large corporate houses. These securities are of very large denominations, very liquid, very safe but offer relatively low interest rates. The cost of trading in the money market (bid-ask spread) is relatively small due to the high liquidity and large size of the market. Since money market instruments are of high denominations they are generally beyond the reach of individual investors. However, individual investors can invest in the money markets through money-market mutual funds. We take a quick look at the various products available for trading in the money markets.

2.4.1 *T-Bills*

T-Bills or treasury bills are largely risk-free (guaranteed by the Government and hence carry only sovereign risk - risk that the government of a country or an agency backed by the government, will refuse to comply with the terms of a loan agreement), short-term, very liquid instruments that are issued by the central bank of a country. The maturity period for T-bills ranges from 3-12 months. T-bills are circulated both in primary as well as in secondary markets. T-bills are usually issued at a discount to the face value and the investor gets the face value upon maturity. The issue price (and thus rate of interest) of T-bills is generally decided at an auction, which individuals can also access. Once issued, T-bills are also traded in the secondary markets.

In India, T-bills are issued by the Reserve Bank of India for maturities of 91-days, 182 days and 364 days. They are issued weekly (91-days maturity) and fortnightly (182-days and 364-days maturity).

2.4.2 *Commercial Paper*

Commercial papers (CP) are unsecured money market instruments issued in the form of a promissory note by large corporate houses in order to diversify their sources of short-term borrowings and to provide additional investment avenues to investors. Issuing companies are required to obtain investment-grade credit ratings from approved rating agencies and in some

cases, these papers are also backed by a bank line of credit. CPs are also issued at a discount to their face value. In India, CPs can be issued by companies, primary dealers (PDs), satellite dealers (SD) and other large financial institutions, for maturities ranging from 15 days period to 1-year period from the date of issue. CP denominations can be Rs. 500,000 or multiples thereof. Further, CPs can be issued either in the form of a promissory note or in dematerialized form through any of the approved depositories.

2.4.3 *Certificates of Deposit*

A certificate of deposit (CD), is a term deposit with a bank with a specified interest rate. The duration is also pre-specified and the deposit cannot be withdrawn on demand. Unlike other bank term deposits, CDs are freely negotiable and may be issued in dematerialized form or as a Usance Promissory Note. CDs are rated (sometimes mandatory) by approved credit rating agencies and normally carry a higher return than the normal term deposits in banks (primarily due to a relatively large principal amount and the low cost of raising funds for banks). Normal term deposits are of smaller ticket-sizes and time period, have the flexibility of premature withdrawal and carry a lower interest rate than CDs. In many countries, the central bank provides insurance (e.g. Federal Deposit Insurance Corporation (FDIC) in the U.S., and the Deposit Insurance and Credit Guarantee Corporation (DICGC) in India) to bank depositors up to a certain amount (Rs. 100000 in India). CDs are also treated as bank deposit for this purpose.

In India, scheduled banks can issue CDs with maturity ranging from 7 days – 1 year and financial institutions can issue CDs with maturity ranging from 1 year – 3 years. CD are issued for denominations of Rs. 1,00,000 and in multiples thereof.

2.5 Repos and Reverse Repos

Repos (or Repurchase agreements) are a very popular mode of short-term (usually overnight) borrowing and lending, used mainly by investors dealing in Government securities. The arrangement involves selling of a tranche of Government securities by the seller (a borrower of funds) to the buyer (the lender of funds), backed by an agreement that the borrower will repurchase the same at a future date (usually the next day) at an agreed price. The difference between the sale price and the repurchase price represents the yield to the buyer (lender of funds) for the period. Repos allow a borrower to use a financial security as collateral for a cash loan at a fixed rate of interest. Since Repo arrangements have T-bills as collaterals and are for a short maturity period, they virtually eliminate the credit risk.

Reverse repo is the mirror image of a repo, i.e., a repo for the borrower is a reverse repo for the lender. Here the buyer (the lender of funds) buys Government securities from the seller (a borrower of funds) agreeing to sell them at a specified higher price at a future date.

2.6 The Bond Market

Bond markets consist of fixed-income securities of longer duration than instruments in the money market. The bond market instruments mainly include treasury notes and treasury bonds, corporate bonds, Government bonds etc.

2.6.1 *Treasury Notes (T-Notes) and T-Bonds*

Treasury notes and bonds are debt securities issued by the Central Government of a country. Treasury notes maturity range up to 10 years, whereas treasury bonds are issued for maturity ranging from 10 years to 30 years. Another distinction between T-notes and T-bonds is that T-bonds usually consist of a call/put option after a certain period. In order to make these instruments attractive, the interest income is usually made tax-free.

Interest on both these instruments is usually paid semi-annually and the payment is referred to as coupon payments. Coupons are attached to the bonds and each bondholder has to present the respective coupons on different interest payment date to receive the interest amount. Similar to T-bills, these bonds are also sold through auction and once sold they are traded in the secondary market. The securities are usually redeemed at face value on the maturity date.

2.6.2 *State and Municipal Government bonds*

Apart from the central Government, various State Governments and sometimes municipal bodies are also empowered to borrow by issuing bonds. They usually are also backed by guarantees from the respective Government. These bonds may also be issued to finance specific projects (like road, bridge, airports etc.) and in such cases, the debts are either repaid from future revenues generated from such projects or by the Government from its own funds. Similar to T-notes and T-bonds, these bonds are also granted tax-exempt status.

In India, the Government securities (includes treasury bills, Central Government securities and State Government securities) are issued by the Reserve Bank of India on behalf of the Government of India.

2.6.3 *Corporate Bonds*

Bonds are also issued by large corporate houses for borrowing money from the public for a certain period. The structure of corporate bonds is similar to T-Notes in terms of coupon payment, maturity amount (face value), issue price (discount to face value) etc. However, since the default risk is higher for corporate bonds, they are usually issued at a higher discount than equivalent Government bonds. These bonds are not exempt from taxes. Corporate bonds are classified as secured bonds (if backed by specific collateral), unsecured bonds (or debentures which do not have any specific collateral but have a preference over the equity holders in the

event of liquidation) or subordinated debentures (which have a lower priority than bonds in claim over a firms' assets).

2.6.4 *International Bonds*

These bonds are issued overseas, in the currency of a foreign country which represents a large potential market of investors for the bonds. Bonds issued in a currency other than that of the country which issues them are usually called Eurobonds. However, now they are called by various names depending on the currency in which they are issued. Eurodollar bonds are US dollar-denominated bonds issued outside the United States. Euro-yen bonds are yen-denominated bonds issued outside Japan.

Some international bonds are issued in foreign countries in currency of the country of the investors. The most popular of such bonds are Yankee bond and Samurai Bonds. Yankee bonds are US dollar denominated bonds issued in U.S. by a non-U.S. issuer and Samurai bonds are yen-denominated bonds issued in Japan by non-Japanese issuers.

2.6.5 *Other types of bonds*

Bonds could also be classified according to their structure/characteristics. In this section, we discuss the various clauses that can be associated with a bond.

Zero Coupon Bonds

Zero coupon bonds (also called as deep-discount bonds or discount bonds) refer to bonds which do not pay any interest (or coupons) during the life of the bonds. The bonds are issued at a discount to the face value and the face value is repaid at the maturity. The return to the bondholder is the discount at which the bond is issued, which is the difference between the issue price and the face value.

Convertible Bonds

Convertible bonds offer a right (but not the obligation) to the bondholder to get the bond converted into predetermined number of equity stock of the issuing company, at certain, pre-specified times during its life. Thus, the holder of the bond gets an additional value, in terms of an option to convert the bond into stock (equity shares) and thereby participate in the growth of the company's equity value. The investor receives the potential upside of conversion into equity while protecting downside with cash flow from the coupon payments.The issuer company is also benefited since such bonds generally offer reduced interest rate. However, the value of the equity shares in the market generally falls upon issue of such bonds in anticipation of the stock dilution that would take place when the option (to convert the bonds into equity) is exercised by the bondholders.

Callable Bonds

In case of callable bonds, the bond issuer holds a call option, which can be exercised after some pre-specified period from the date of the issue. The option gives the right to the issuer to repurchase (cancel) the bond by paying the stipulated call price. The call price may be more than the face value of the bond. Since the option gives a right to the issuer to redeem the bond, it carries a higher discount (higher yield) than normal bonds. The right is exercised if the coupon rate is higher than the prevailing interest rate in the market.

Puttable Bonds

A puttable bond is the opposite of callable bonds. These bonds have an embedded put option. The bondholder has a right (but not the obligation) to sell back the bond to the issuer after a certain time at a pre-specified price. The right has a cost and hence one would expect a lower yield in such bonds. The bondholders generally exercise the right if the prevailing interest rate in the market is higher than the coupon rate.

Since the call option and the put option are mutually exclusive, a bond may have both option embedded.

Fixed rate and floating rate of interest

In case of fixed rate bonds, the interest rate is fixed and does not change over time, whereas in the case of floating rate bonds, the interest rate is variable and is a fixed percentage over a certain pre-specified benchmark rate. The benchmark rate may be any other interest rate such as T-bill rate, the three-month LIBOR rate, MIBOR rate (in India), bank rate, etc. The coupon rate is usually reset every six months (time between two interest payment dates).

2.7 Common Stocks

Simply put, the shareholders of a company are its owners. As owners, they participate in the management of the company by appointing its board of directors and voicing their opinions, and voting in the general meetings of the company. The board of directors have general oversight of the company, appoints the management team to look after the day-to-day running of the business, set overall policies aimed at maximizing profits and shareholder value. Shareholders of a company are said to have limited liability. The term means that the liability of shareholders is limited to the unpaid amount on the shares. This implies that the maximum loss of shareholder in a company is limited to her original investment. Being the owners, shareholders have the last claim on the assets of the company at the time of liquidation, while debt- or bondholders always have precedence over equity shareholders.

At its incorporation, every company is authorized to issue a fixed number of shares, each priced at par value, or face value in India. The face value of shares is usually set at nominal

levels (Rs. 10 or Re. 1 in India for the most part). Corporations generally retain portions of their authorized stock as reserved stock, for future issuance at any point in time.

Shares are usually valued much higher than the face value and this initial investment in the company by shareholders represents their paid-in capital in the company. The company then generates earnings from its operating, investing and other activities. A portion of these earnings are distributed back to the shareholders as dividend, the rest retained for future investments. The sum total of the paid-in capital and retained earnings is called the book value of equity of the company.

2.7.1 *Types of shares*

In India, shares are mainly of two types: equity shares and preference shares. In addition to the most common type of shares, the equity share, each representing a unit of the overall ownership of the company, there is another category, called preference shares. These preferred shares have precedence over common stock in terms of dividend payments and the residual claim to its assets in the event of liquidation. However, preference shareholders are generally not entitled to equivalent voting rights as the common stockholders.

In India, preference shares are redeemable (callable by issuing firm) and preference dividends are cumulative. By cumulative dividends, we mean that in case the preference dividend remains unpaid in a particular year, it gets accumulated and the company has the obligation to pay the accrued dividend and current year's dividend to preferred stockholders before it can distribute dividends to the equity shareholders. An additional feature of preferred stock in India is that during such time as the preference dividend remains unpaid, preference shareholders enjoy all the rights (e.g. voting rights) enjoyed by the common equity shareholders. Some companies also issue convertible preference shares which get converted to common equity shares in future at some specified conversion ratio.

In addition to the equity and fixed-income markets, the derivatives market is one of India's largest and most liquid. We take a short tour of derivatives in the 5th chapter of this module.

CHAPTER 3: Fixed Income Securities

3.1 Introduction: The Time Value of Money

Fixed-income securities are securities where the periodic returns, time when the returns fall due and the maturity amount of the security are pre-specified at the time of issue. Such securities generally form part of the debt capital of the issuing firm. Some of the common examples are bonds, treasury bills and certificates of deposit.

3.2 Simple and Compound Interest Rates

In simple terms, an interest payment refers to the payment made by the borrower to the lender as the price for use of the borrowed money over a period of time. The interest cost covers the opportunity cost of money, i.e., the return that could have been generated had the lender invested in some other assets and a compensation for default risk (risk that the borrower will not refund the money on maturity). The rate of interest may be fixed or floating, in that it may be linked to some other benchmark interest rate or in some cases to the inflation in the economy.

Interest calculations are either simple or compound. While simple interest is calculated on the principal amount alone, for a compound interest rate calculation we assume that all interest payments are re-invested at the end of each period. In case of compound interest rate, the subsequent period's interest is calculated on the original principal and all accumulated interest during past periods.

In case of both simple and compound interest rates, the interest rate stated is generally annual. In case of compound interest rate, we also mention the frequency for which compounding is done. For example, such compounding may be done semi-annually, quarterly, monthly, daily or even instantaneously (continuously compounded).

3.2.1 *Simple Interest Rate*

The formula for estimating simple interest is :

$$I = P * R * T$$

Where,

P = principal amount

R = Simple Interest Rate for one period (usually 1 year)

T = Number of periods (years)

Example 3.1

What is the amount an investor will get on a 3-year fixed deposit of Rs. 10000 that pays 8% simple interest?

Answer: Here we have

P = 10000, R = 8% and T = 3 years

$I = P * R * T = 10000 * 8\% * 3 = 2400$

Amount = Principal + Interest = 10000+2400 = 12400.

3.2.2 *Compound Interest Rate*

In addition to the three parameters (Principal amount (P), Interest Rate (R), Time (T)) used for calculation of interest in case of simple interest rate method, there is an additional parameter that affects the total interest payments. The fourth parameter is the compounding period, which is usually represented in terms of number of times the compounding is done in a year (m). So for semi-annual compounding the value for m = 2; for quarterly compounding, m = 4 and so on.

Let us consider an interest rate of 10% compounded semi-annually and an investment of Rs. 100 for a period of 1 year. The investment will become Rs. 105 in 6 months and for the second half, the interest will be calculated on Rs. 105, which will come to 105*5% = 5.25. The total amount the investor will receive at the end of 1 year will become 105 + 5.25 = 110.25. The equivalent interest rate, if compounded annually becomes ((110.25-100)/100)*100 = 10.25%. The equivalent annual interest rate is $\left(1 + \frac{R}{m}\right)^m - 1$.

The formula used for calculating total amount under this method is as under:

$$A = P\left(1 + \frac{R}{m}\right)^{T*m} - P$$

Where

A = Amount on maturity

R = interest rate

m = number of compounding in a year

T = maturity in years

Example 3.2

What is the amount an investor will get on a 3-year fixed deposit of Rs. 10000 that pay 8% interest compounded half yearly?

Answer:

Here P = 10000, R = 8% and T = 3, m = 2. The total interest income comes to:

$$Interest = \left[P\left(1+\frac{R}{m}\right)^{T*m}\right] - P$$

$$= \left[10000 * \left(1+\frac{0.08}{2}\right)^{2*3}\right] - 10000 = Rs.2653.20$$

Amount = Principal + Interest = 10000+2653.20 = 12653.20.

Example 3.3

Consider the same investment. What is the amount if the interest rate is compounded monthly?

Answer:

Here P = 10000, R = 8% and T = 3, m = 12. The total interest income comes to:

$$Interest = \left[P\left(1+\frac{R}{m}\right)^{T*m}\right] - P$$

$$= \left[10000 * \left(1+\frac{0.08}{12}\right)^{12*3}\right] - 10000 = Rs.2702.37$$

Amount = Principal + Interest = 10000+2702.37 = 12702.37.

Continuous compounding

Consider a situation, where instead of monthly or quarterly compounding, the interest rate is compounded continuously throughout the year i.e. m rises indefinitely. If m approaches infinity, the equivalent annual interest rate is $\left(1+\frac{R}{\infty}\right)^{\infty} - 1$, which can be shown (using tools from differential calculus), to tend to $[2.718^{r} - 1]$ or $e^{r} - 1$ in the limit, (where e=2.71828... is the base for natural logarithms). Further, for convenience, we use 'r' (in small letters) to represent continuously compound interest rate.

Thus, an investment of Re. 1 at 8% continuously compounded interest becomes $e^{0.08} = 1.0833$ after 1 year and the equivalent annual interest rate becomes 0.0833 or 8.33%. If the investment is for T years, the maturity amount is simply $1 * e^{rT}$, where e = 2.718.

Continuous compounding is widely assumed in finance theory, and used in various asset pricing models—the famous Black-Scholes model to price a European option is an illustrative example.

Example 3.4

Consider the same investment (Rs. 10000 for 3 years). What is the amount received on

maturity if the interest rate is 8% compounded continuously?

Answer:

Here P = 10000, e = 2.718, r = 8% and T = 3

The final value of the investment is $P * e^{rT}$.

It comes to $10000 * e^{0.08*3} = 12712.50$.

3.3 Real and Nominal Interest Rates

The relationship between interest rates and inflation rates is very significant. Normally, the cash flow from bonds and deposits are certain and known in advance. However, the value of goods and services in an economy may change due to changes in the general price level (inflation). This brings an uncertainty about the purchasing power of the cash flow from an investment. Take a small example. If inflation (say 12%) is rising and is greater than the interest rate (say 10% annually) in a particular year, then an investor in a bond with 10% interest rate annually stands to lose. Goods worth Rs. 100 at the beginning of the year are worth Rs. 112 by the end of the year but an investment of Rs. 100 becomes only Rs. 110 by end of the year. This implies that an investor who has deposited money in a risk-free asset will find goods beyond his reach.

An economist would look at this in terms of nominal cash flow and real cash flows. Nominal cash flow measures the cash flow in terms of today's prices and real cash flow measures the cash flow in terms of its base year's purchasing power, i.e., the year in which the asset was bought/ invested. If the interest rate is 10%, an investment of Rs. 100 becomes Rs. 110 at the end of the year. However, if inflation rate is 5% then each Rupee will be worth 5% less next year. This means at the end of the year, Rs. 110 will be worth only 110/1.05 = Rs. 104.76 in terms of the purchasing power at the beginning of the year. The real payoff is Rs. 104.76 and the real interest rate is 4.76%. The relationship between real and nominal interest rate can be established as under:

$$Real\ \ Cash\ Flow = \frac{Nominal\ Cash\ Flow}{(1 + inflation\ rate)}$$

And

$$(1 + real\ interest\ rate = \frac{1 + nominal\ \ interest\ \ rate}{1 + inflation\ \ rate}$$

In our example, the real interest rate can be directly calculated using the formula:

$$Real\ interest\ rate = \left[\frac{1 + 0.10}{1 + .05}\right] - 1 = 0.0476 \text{ or } 4.76\%$$

3.4 Bond Pricing Fundamentals

The cash inflow for an investor in a bond includes the coupon payments and the payment on maturity (which is the face value) of the bond. Thus the price of the bond should represent the sum total of the discounted value of each of these cash flows (such a total is called the present value of the bond). The discount rate used for valuing the bond is generally higher than the risk-free rate to cover additional risks such as default risk, liquidity risks, etc.

Bond Price = PV (Coupons and Face Value)

Note that the coupon payments are at different points of time in the future, usually twice each year. The face value is paid at the maturity date. Therefore, the price is calculated using the following formula:

$$Bond\ Price = \sum_{t} \frac{C(t)}{(1+y)^t} \qquad (1)$$

Where C(t) is the cash flow at time t and y is the discount rate. Since the coupon rate is generally fixed and the maturity value is known at the time of issue of the bond, the formula can be re-written as under:

$$Bond\ Price = \sum_{t}^{T} \frac{Coupon}{(1+y)^t} + \frac{Face\ Value}{(1+y)^T} \qquad (2)$$

Here t represents the time left for each coupon payment and T is the time to maturity. Also note that the discount rate may differ for cash flows across time periods.

Example 3.5

Calculate the value of a 3-year bond with face value of Rs. 1000 and coupon rate being 8% paid annually. Assume that the discount rate is 10%.

Here:

Face value = Rs. 1000

Coupon Payment = 8% of Rs. 1000 = Rs. 80

Discount Rate = 10%

t=1 to 3

T = 3

$$Bond\ Price = \frac{80}{1+0.1} + \frac{80}{(1+0.1)^2} + \frac{80}{(1+0.1)^3} + \frac{1000}{(1+0.1)^3} = 950.26$$

Now let us see what happens if the discount rate is lower than the coupon rate:

Example 3.6

Calculate the bond price if the discount rate is 6%.

$$Bond\ Price = \frac{80}{1+0.06} + \frac{80}{(1+0.06)^2} + \frac{80}{(1+0.06)^3} = 1053.46$$

Since the discount rate is higher than the coupon rate, the bond is traded at a discount. If the discount rate is less than the coupon rate, the bond trades at a premium.

3.4.1 *Clean and dirty prices and accrued interest*

Bonds are not traded only on coupon dates but are traded throughout the year. The market price of the bonds also includes the accrued interest on the bond since the most recent coupon payment date. The price of the bond including the accrued interest since issue or the most recent coupon payment date is called the 'dirty price' and the price of the bond excluding the accrued interest is called the 'clean price'. Clean price is the price of the bond on the most recent coupon payment date, when the accrued interest is zero.

Dirty Price = Clean price + Accrued interest

For reporting purpose (in press or on trading screens), bonds are quoted at 'clean price' for ease of comparison across bonds with differing interest payment dates (dirty prices 'jump' on interest payment dates). Changes in the more stable clean prices are reflective of macroeconomic conditions, usually of more interest to the bond market.

3.5 Bond Yields

Bond yield are measured using the following measures:

3.5.1 *Coupon yield*

It is calculated using the following formula:

$$Coupon\ Yield = \frac{Coupon\ Payment}{Face\ Value}$$

3.5.2 *Current Yield*

It is calculated using the following formula:

$$Coupon\ Yield = \frac{Coupon\ Payment}{Current\ Market\ Price\ of\ the\ Bond}$$

The main drawback of coupon yield and current yield is that they consider only the interest payment (coupon payments) and ignore the capital gains or losses from the bonds. Since they consider only coupon payments, they are not measurable for bonds that do not pay any interest, such as zero coupon bonds. The other measures of yields are yield to maturity and

yield to call. These measures consider interest payments as well as capital gains (or losses) during the life of the bond.

3.5.3 *Yield to maturity*

Yield to maturity (also called YTM) is the most popular concept used to compare bonds. It refers to the internal rate of return earned from holding the bond till maturity. Assuming a constant interest rate for various maturities, there will be only one rate that equalizes the present value of the cash flows to the observed market price in equation (2) given earlier. That rate is referred to as the yield to maturity.

Example 3.7

What is the YTM for a 5-year, 8% bond (interest is paid annually) that is trading in the market for Rs. 924.20?

Here,

t= 1 to 5

T = 5

Face Value = 1000

Coupon payment = 8% of Rs. 1,000 = 80

Putting the values in equation (1), we have:

$$924.20 = \sum_{1}^{5} \frac{80}{(1+y)^t} + \frac{1000}{(1+y)^5}$$

Solving for y, which is the YTM, we get the yield to maturity for the bond to be 10%.

Yield and Bond Price:

There is a negative relationship between yields and bond price. The bond price falls when yield increases and vice versa.

Example 3.8

What will be the market price of the above bond (Example 3 7) if the YTM is 12%.

t= 1 to 5

T = 5

Face Value = 1000

Coupon payment = 8% of 1,000 = 80

Putting the values in equation (1), the bond price comes to:

$$\textbf{Bond Price} = \sum_{1}^{5} \frac{80}{(1+0.12)^t} + \frac{1000}{(1+0.12)^5} = 901.20$$

Further, for a long-term bond, the cash flows are more distant in the future and hence the impact of change in interest rate is higher for such cash flows. Alternatively, for short-term bonds, the cash flows are not far and discounting does not have much effect on the bond price. Thus, price of long-term bonds are more sensitive to interest rate changes.

Bond equivalent yield and Effective annual yield: This is another important concept that is of importance in case of bonds and notes that pay coupons at time interval which is less than 1 year (for example, semi-annually or quarterly). In such cases, the yield to maturity is the discount rate solved using the following formula, wherein we assume that the annual discount rate is the product of the interest rate for interval between two coupon payments and the number of coupon payments in a year:

$$\textbf{Bond Price} = \sum_{t}^{T} \frac{\textbf{Coupon}}{\left(1+\frac{y}{2}\right)^t} + \frac{\textbf{Face Value}}{\left(1+\frac{y}{2}\right)^T} \qquad (3)$$

YTM calculated using the above formula is called bond equivalent yield.

However, if we assume that one can reinvest the coupon payments at the bond equivalent yield (YTM), the effective interest rate will be different. For example, a semi-annual interest rate of 10% p.a. in effect amounts to

$$\left(1+\frac{0.10}{2}\right)^2 = 1.1025 \textit{ or } 10.25\% .$$

Yield rate calculated using the above formula is called effective annual yield.

Example 3.9

Calculate the bond equivalent yield (YTM) for a 5-year, 8% bond (semi-annual coupon payments), that is trading in the market for Rs. 852.80? What is the effective annual yield for the bond?

Here,

t= 1 to 10

T = 10

Face Value = 1000

Coupon payment = 4% of 1,000 = 40

Bond Price = 852.80

Putting the values in equation (3), we have:

$$852.80 = \sum_{1}^{10} \frac{40}{\left(1+\frac{y}{2}\right)^{t}} + \frac{1000}{\left(1+\frac{y}{2}\right)^{10}}$$

Solving, we get the Yield to Maturity (y) = 0.12 or 12%.

The effective yield rate is

$$\left(1+\frac{y}{2}\right)^{2} - 1 = \left(1+\frac{0.12}{2}\right)^{2} - 1 = 0.1236 \text{ or } 12.36\%$$

3.5.4 *Yield to call*

Yield to call is calculated for callable bond. A callable bond is a bond where the issuer has a right (but not the obligation) to call/redeem the bond before the actual maturity. Generally the callable date or the date when the company can exercise the right, is pre-specified at the time of issue. Further, in the case of callable bonds, the callable price (redemption price) may be different from the face value. Yield to call is calculated with the same formula used for calculating YTM (Equation 2), with an assumption that the issuer will exercise the call option on the exercise date.

Example 3.10

Calculate the yield to call for a 5-year, 7% callable bond (semi-annual coupon payments), that is trading in the market for Rs. 877.05. The bond is callable at the end of 3rd year at a call price of Rs. 1040.

Here:

t= 1 to 6

T = 6

Coupon payment = 3.5% of 1,000 = 35

Callable Value = 1040

Bond Price = 877.05

Putting the values in the following equation:

$$\textit{Bond Price} = \sum_{t}^{T} \frac{\textit{Coupon}}{\left(1+\frac{y}{2}\right)^{t}} + \frac{\textit{Callable Value}}{\left(1+\frac{y}{2}\right)^{T}}$$

we have:

$$877.05 = \sum_{1}^{6} \frac{35}{\left(1+\frac{y}{2}\right)^{t}} + \frac{1000}{\left(1+\frac{y}{2}\right)^{6}}$$

Solving for y, we get the yield to call = 12%

3.6 Interest Rates

While computing the bond prices and YTM, we assumed that the interest rate is constant across different maturities. However, this may not be true for different reasons. For example, investors may perceive longer maturity periods to be riskier and hence may demand higher interest rate for cash flow occurring at distant time intervals than those occurring at short time intervals. In this section, we account for the fact that the interest demanded by investors also depends on the time horizon of the investment. Let us first introduce certain common concepts.

3.6.1 *Short Rate*

Short rate for time t, is the expected (annualized) interest rate at which an entity can borrow for a given time interval starting from time t. Short rate is usually denominated as r_t.

3.6.2 *Spot Rate*

Yield to maturity for a zero coupon bond is called spot rate. Since zero coupon bonds of varying maturities are traded in the market simultaneously, we can get an array of spot rates for different maturities.

Relationship between short rate and spot rate:

Investors discount future cash flows using interest rate applicable for that period. Therefore, the PV of an investment of T years is calculated as under:

$$PV\ (Investment) = \frac{(Initial\ Investment)}{(1+r_1)\,(1+r_2)\ldots(1+r_T)}$$

Example 3.11

If the short rate for a 1-year investment at year 1 is 7% and year 2 is 8%, what is the present value of a 2-year zero coupon bond with face value Rs. 1000 :

$$P = \frac{1000}{1.07 * 1.08} = \frac{1000}{1.1556} = 865.35$$

For a 2-year zero coupon bond trading at 865.35, the YTM can be calculated by solving the following equation:

$$865.35 = \frac{1000}{(1+y_2)^2}$$

The resulting value for y is 7.4988%, which is nothing but the 2-year spot rate.

3.6.3 *Forward Rate*

One can assume that all bonds with equal risks must offer identical rates of return over any holding period, because if it is not true then there will be an arbitrage opportunity in the market. If we assume that all equally risky bonds will have identical rates of return, we can calculate short rates for a future interval by knowing the spot rates for the two ends of the interval. For example, we can calculate 1-year short rate at year 3, if we have the 3-years spot rate and 4-years spot rate (or in other words are there are 3-year zero coupon and a 4-year zero coupon treasury bonds trading in the market). This is because, the proceeds from an investment in a 3-year zero coupon bond on the maturity day, reinvested for 1 year should result in a cash flow equal to the cash flow from an investment in a 4-year zero coupon bond (since the holding period is the same for both the strategies).

Example 3.12

If the 3-year spot rate and 4-year spot rates are 8.997% and 9.371% respectively, find the 1-year short rate at end of year 3.

Given the spot rates, proceeds from investment of Re. 1 in a 3-year zero coupon bond will be $1 * 1.08997^3 = 1.2949$.

If we reinvest this (maturity) amount in a 1-year zero coupon bond, the proceeds at year 4 will be $1.2949*(1+r_3)$.

This should be equal to the proceeds from an investment of Rs. 1 in a 4-year zero coupon bond, assuming equal holding period return.

Proceeds from investment of Re. 1 in a 4-year zero coupon bond is $1*1.09371^4 = 1.4309$

Solving,

$$1.2949 * (1 + r_3) = 1.4309$$

r_3= 0.11 or 11%, which is nothing but the 1 year short rate at the end of year 3.

Future short rates computed using the market price of the prevailing zero coupon bonds' price (or prevailing spot rates) are called forward interest rates. We use the notation f_i to represent the 1-year forward interest rate starting at year *i*. For example, f_2 denotes the 1-year forward interest rate starting from year 2.

3.6.4 *The term structure of interest rates*

We have discussed various interest rates (spot, forward, discount rates), and also seen their behaviour, and connections with each other. The term structure of interest rates is the set of relationships between rates of bonds of different maturities. It is sometimes also called the

yield curve. Formally put, the term structure of interest rates defines the array of discount factors on a collection of default-free pure discount (zero-coupon) bonds that differ only in their term to maturity. The most common approximation to the term structure of interest rates is the yield to maturity curve, which generally is a smooth curve and reflects the rates of return on various default-free pure discount (zero-coupon) bonds held to maturity along with their term to maturity.

The use of forward interest rates has long been standard in financial analysis such as in pricing new financial instruments and in discovering arbitrage possibilities. Yield curves are also used as a key tool by central banks in the determination of the monetary policy to be followed in a country. The forward interest rate is interpreted as indicating market expectations of the time-path of future interest rates, future inflation rates and future currency depreciation rates. Since forward rates helps us indicate the expected future time path of these variables, they allow a separation of market expectations for the short, medium and long term more easily than the standard yield curve.

The market expectations hypothesis and the liquidity preference theory are two important explanations of the term structure of interest in the economy. The market expectation hypothesis assumes that various maturities are perfect substitutes of each other and that the forward rate equals the market expectation of the future short interest rate i.e. $f_i = E(r_i)$, where *i* is a future period. Assuming minimal arbitrage opportunities, the expected interest rate can be used to construct a yield curve. For example, we can find the 2-year yield if we know the 1-year short rate and the futures short rate for the second year by using the following formula:

$$(1 + y_2)^2 = (1 + r_1) * (1 + f_2)$$

Since, as per the expectation hypothesis $- f_2 = E(R_2)$, the YTM can be determined solely by current and expected future one-period interest rates.

Liquidity preference theory suggests that investors prefer liquidity and hence, a short-term investment is preferred to a long-term investment. Therefore, investors will be induced to hold a long-term investment, only by paying a premium for the same. This premium or the excess of the forward rate over the expected interest rate is referred to as the liquidity premium. Therefore, the forward rate will exceed the expected short rate, i.e. $f_2 > E(r_2)$, where $f_2 - E(r_2)$ represent the liquidity premium. The liquidity premium causes the yield curve to be upward sloping since long-term yields are higher than short-term yields.

Example 3.13

Calculate the YTM for year 2-5 if the 1-year short rate is 8% and the future rates for years 2- 5 is 8.5% (f_2), 9% (f_3), 9.5% (f_4) and 10%(f_5) respectively.

Answer:

$y_1 = r_1 = 8\%$

$(1+y_2)^2 + (1+r_1) * (1+f_2); y_2 = \sqrt[2]{(1.08 * 1.085)} = 1.0825$, i.e. $y_2 = 8.25\%$

$(1+y_3)^3 + (1+y_2)^2 * (1+f_3); y_3 = \sqrt[3]{(1.0825^2 * 1.09)} = 1.0850$, i.e. $y_3 = 8.50\%$

$(1+y_4)^4 + (1+y_3)^3 * (1+f_4); y_4 = \sqrt[4]{(1.0850^3 * 1.095)} = 1.0875$, i.e. $y_4 = 8.75\%$

$(1+y_5)^5 + (1+y_4)^4 * (1+f_5); y_5 = \sqrt[5]{(1.0875^4 * 1.10)} = 1.09$, i.e. $y_5 = 9.00\%$

It can be seen that because of the liquidity premium, the future interest rate increases with time and this causes the yield curve to rise with time.

Box No. 3.1:

Relationship between spot, forward, and discount rates

Recall that discount factors are the interest rates used at a given point in time to discount cash flows occurring in the future, in order to obtain their present value. So how do spot rates, forward rates, and discount rates relate to each other?

A discount function ($d_{t,m}$) is the collection of discount factors at time t for all maturities m. Spot rates ($s_{t,m}$), i.e., the yields earned on bonds which pay no coupon, are related to discount factors according to:

$$d_{t,m} = e^{m^* - s_{1m}} \quad \text{and}$$

$$S_{t,m} = -\frac{1}{m} 1n d_{t,m}$$

The estimation of a zero coupon yield curve is based on an assumed functional relationship between either par yields, spot rates, forward rates or discount factors on the one hand and maturities on the other. Par yield curves are those that reflect return on bonds that are priced at par, which just means that the redemption yield is equal to the coupon rate of the bond.

There is a different forward rate for every pair of maturity dates. The relation between the yield-to-maturity (YTM) and the implied forward rate at maturity is analogous to the relation between average and marginal costs in economics. The YTM is the average cost of borrowing for m periods whereas the implied forward rate is the marginal cost of extending the time period of the loan, i.e. it describes the marginal one-period interest rate implied by the current term structure of spot interest rate. Because spot interest

rates depend on the time horizon, it is natural to define the forward rates $f_{t,m}$ as the instantaneous rates which when compounded continuously up to the time to maturity, yield the spot rates (instantaneous forward rates are thus rates for which the difference between settlement time and maturity time approaches zero).

$$S_{t,m} = -\frac{1}{m}\int_0^m f\ (u)\ du\ ,$$ or we can say

$$d_{t,m} = \exp\left[\int_0^m f(u)du\right]$$

Thus, knowing any of the four means that the other four can be readily computed. However, the real problem is that neither of these curves is easily forecast able.

3.7 Macaulay Duration and Modified Duration

The effect of interest rate risks on bond prices depends on many factors, but mainly on coupon rates, maturity date etc. Unlike in case of zero-coupon bonds, where the cash flows are only at the end, in the case of other bonds, the cash flows are through coupon payments and the maturity payment. One needs to average out the time to maturity and time to various coupon payments to find the effective maturity for a bond. The measure is called as duration of a bond. It is the weighted (cash flow weighted) average maturity of the bond.

$$Duration = \sum_{t=1}^{T} t\ *\ w_t$$

The weights (Wt) associated for each period are the present value of the cash flow at each period as a proportion to the bond price, i.e.

$$W_t = \frac{PV\ of\ cash\ flow}{Bond\ Price} = \frac{\frac{CF_t}{(1+y)^t}}{Bond\ Price}$$

This measure is termed as *Macaulay's duration*[1] or simply, duration. Higher the duration of the bond, higher will be the sensitivity towards interest rate fluctuations and hence higher the volatility in the bond price.

This tool is widely used in fixed income analysis. Banks and other financial institutions generally create a portfolio of fixed income securities to fund known liabilities. The price changes for fixed income securities are dependent mainly on the interest rate changes and the average

[1]The method was designed by Frederick Macaulay in 1856 and hence named as Macaulay Duration.

maturity (duration). In order to hedge against interest rate risks, it is essential for them to match the duration of the portfolio of fixed income securities with that of the liabilities. A bank thus needs to rebalance its portfolio of fixed-income securities periodically to ensure that the aggregate duration of the portfolio is kept equal to the time remaining to the target date. One should note that the duration of a short-term bond declines faster than the duration of the long-term bond. When interest rates fall, the reinvestment of interests (until the target date) will yield a lower value but the capital gain arising from the bond is higher. The increase or decrease in the coupon income arising from changes in the reinvestment rates will offset the opposite changes in the market values of the bonds in the portfolios. The net realized yield at the target date will be equal to the yield to maturity of the original portfolio. This is also called bond *portfolio immunization*.

Example 3.14

What is the duration for a 5-year maturity, 7% (semi-annual) coupon bond with yield to maturity of 12%?

Here:

t = 1 to 10

T = 10

Coupon payment = 3.5% of 1,000 = 35

YTM = 12 % or 6% for half year.

Period (a)	Time till payment (b)	Cash Flow (c)	PV of Cash Flow (discount = 6% per period) (d)	Weights (e) (33.02/816)	(b)*(e) (f)
1	0.5	35	33.02	= 0.0405	0.0202
2	1	35	31.15	0.0382	0.0382
3	1.5	35	29.39	0.0360	0.0540
4	2	35	27.72	0.0340	0.0679
5	2.5	35	26.15	0.0321	0.0801
6	3	35	24.67	0.0302	0.0907
7	3.5	35	23.28	0.0285	0.0998
8	4	35	21.96	0.0269	0.1076
9	4.5	35	20.72	0.0254	0.1142
10	5	1035	577.94	0.7083	3.5413
Sum			816.00	1.0000	4.2142

The selling price of the bond as calculated from column (d) is Rs. 816.00. The duration of the bond is 4.2142 years.

Since for a zero coupon bond, the cash flow is only on the maturity date, the duration equals the bond maturity. For coupon-paying bonds, the duration will be less than the maturity period. Since cash flows at each time are used as weights, the duration of a bond is inversely related to the coupon rate. A bond with high coupon rate will have lower duration as compared to a bond with low coupon rate.

Example 3.15

What is the duration for a 5-year maturity zero coupon bond with yield to maturity of 12%?

Answer: One does not need to do any calculation for answering this question. All cash flows are only on the maturity date and hence the duration for this bond is the maturity date.

Although duration helps us in measuring the effective maturity of the bond, investors are concerned more about the bond price sensitivity with respect to change in interest rates. In order to measure the price sensitivity of the bond with respect to the interest rate movements, we need to find the so-called modified duration (MD) of the bond. Modified duration is calculated from duration (D) using the following formula:

$$MD = \frac{D}{1 + \frac{y}{n}},$$

Where,

y = yield to maturity of the bond

n = number of coupon payments in a year.

The price change sensitivity of modified duration is calculated using the following formula:

$$Price\ Change\ (\%) = (-)\ MD * Yield\ Change$$

Note the use of minus (-) term. This is because price of a bond is negatively related to the yield of the bond.

Example 3.16

Refer to the bond in Example 3 14 i.e. 5-year maturity, 7% (semi-annual) coupon bond with yield to maturity of 12%. Calculate the change in bond price if the YTM falls to 11%.

Answer: In Example 3 14, we calculated the duration to be 4.2142 and the bond price to be 816. The modified duration of the bond is:

$$MD = \frac{D}{1 + \frac{y}{n}} = \frac{4.2142}{1 + \frac{.12}{2}} = \frac{4.2142}{1.06} = 3.976$$

The price change will -3.976*1 = 3.976% or Rs. 816 * 3.976% = 32.45

New Price = 816 + 32.45 = 848.45

Check: The actual market price of a 5-year maturity, 7% (semi-annual) coupon bond with YTM = 11% would be:

$$Bond\ Price = \sum_{t}^{T} \frac{Coupon}{\left(1 + \frac{y}{2}\right)^{t}} + \frac{Face\ Value}{\left(1 + \frac{y}{2}\right)^{T}} = \sum_{t=1}^{10} \frac{35}{\left(1 + \frac{0.11}{2}\right)^{t}} + \frac{1000}{\left(1 + \frac{0.11}{2}\right)^{10}} = 849.25$$

Note that there is still some minor differences in the actual price and the bond price calculated using the modified duration formula, due to what is called 'convexity'. However, we would not be covering the concept in this chapter.

CHAPTER 4: Capital Market Efficiency

4.1 Introduction

The Efficient Markets Hypothesis (EMH) is one of the main pillars of modern finance theory, and has had an impact on much of the literature in the subject since the 1960's when it was first proposed and on our understanding about potential gains from active portfolio management. Markets are efficient when prices of securities assimilate and reflect information about them. While markets have been generally found to be efficient, the number of departures seen in recent years has kept this topic open to debate.

4.2 Market Efficiency

The extent to which the financial markets digest relevant information into the prices is an important issue. If the prices fully reflect all relevant information instantaneously, then market prices could be reliably used for various economic decisions. For instance, a firm can assess the potential impact of increased dividends by measuring the price impact created by the dividend increase. Similarly, a firm can assess the value of a new investment taken up by ascertaining the impact on its market price on the announcement of the investment decision. Policymakers can also judge the impact of various macroeconomic policy changes by assessing the market value impact. The need to have an understanding about the ability of the market to imbibe information into the prices has led to countless attempts to study and characterize the levels of efficiency of different segments of the financial markets.

The early evidence suggests a high degree of efficiency of the market in capturing the price relevant information. Formally, the level of efficiency of a market is characterized as belonging to one of the following (i) weak-form efficiency (ii) semi-strong form efficiency (iii) strong-form efficiency.

4.2.1 *Weak-form Market Efficiency*

The weak-form efficiency or random walk would be displayed by a market when the consecutive price changes (returns) are uncorrelated. This implies that any past pattern of price changes are unlikely to repeat by itself in the market. Hence, technical analysis that uses past price or volume trends do not to help achieve superior returns in the market. The weak-form efficiency of a market can be examined by studying the serial correlations in a return time series. Absence of serial correlation indicates a weak-form efficient market.

4.2.2 *Semi-strong Market Efficiency*

The semi-strong form efficiency implies that all the publicly available information gets reflected in the prices instantaneously. Hence, in such markets the impact of positive (negative)

information about the stock would lead to an instantaneous increase (decrease) in the prices. Semi-strong form efficiency would mean that no investor would be able to outperform the market with trading strategies based on publicly available information.

The hypothesis suggests that only information that is not publicly available can benefit investors seeking to earn abnormal returns on investments. All other information is accounted for in the stocks price and regardless of the amount of fundamental and technical analysis one performs, above normal returns will not be had.

The semi-strong form efficiency can be tested with event-studies. A typical event study would involve assessment of the abnormal returns around a significant information event such as buyback announcement, stock splits, bonus etc. Here, a time period close to the selected event including the event date would be used to examine the abnormal returns. If the market is semi-strong form efficient, the period after a favorable (unfavorable) event would not generate returns beyond (less than) what is suggested by an equilibrium pricing model (such as CAPM, which has been discussed later in the book).

4.2.3 *Strong Market Efficiency*

The level of efficiency ideally desired for any market is strong form efficiency. Such efficiency would imply that both publicly available information and privately (non-public) available information are fully reflected in the prices instantaneously and no one can earn excess returns. A test of strong form efficiency would be to ascertain whether insiders of a firm are able to make superior returns compared to the market. Absence of superior return by the insiders would imply that the market is strongly efficient. Testing the strong-form efficiency directly is difficult. Therefore, the claim about strong form efficiency of any market at the best remains tenuous.

In the years immediately following the proposal of the market efficiency, tests of various forms of efficiency had suggested that the markets are reasonably efficient. Over time, this led to the gradual acceptance of the efficiency of markets.

4.3 Departures from the EMH

Evidence accumulated through research over the past two decades, however, suggests that during many episodes the markets are not efficient even in the weak form. The returns are found to be correlated both for short as well as long lags during such episodes. The downward and upward trending of prices is well documented across different markets (momentum effect). Then there is a whole host of other documented deviations from efficiency. They include, the predictability of future returns based on certain events and high volatility of prices compared to volatility of the underlying fundamentals. All these evidences have started to offer a challenge to the earlier claim of efficiency of the market. The lack of reliability about the level of efficiency of the market prices makes it less reliable as a guideline for decision-making.

Alternative prescriptions about the behaviour of markets are widely discussed these days. Most of these prescriptions are based on the irrationality of the markets in either processing the information related to an event or based on biased investor preferences. For instance, if the investors on an average are overconfident about their investment ability, they would not pay close attention to new price relevant information that arises in the market. This leads to inadequate price response to the information event and possibly continuation of the trend due to the under reaction. This bias in processing information is claimed to be the cause of price momentum. Biased investor preferences include aversion to the realization of losses incurred in a stock. This again would lead to under reaction.

The market efficiency claim was based on the assumption that irrational (biased) investors would be exploited by the rational traders, and would eventually lose out in the market, leading to their exit. Therefore, even in the presence of biased traders the market was expected to evolve as efficient. However, more recent evidence suggest that the irrational traders are not exiting the market as expected, instead at many instances they appear to make profits at the expense of the rational traders.

Some of the well-known anomalies—or departures from market efficiency—are calendar effects like the January effect and various day-of-the-week effects and the so-called size effect. The January effect was first documented in the US markets—stock returns were found to be higher in January than in any other month. Since then, it has been empirically tested in a number of international markets, like Tokyo, London, and Paris among others. While the evidence has been mixed, the fact that it exists implies a persistent deviation from market efficiency.

Stock returns are generally expected to be independent across weekdays, but a number of studies have found returns on Monday to be lower than in the rest of the week. One of the reasons put forward to explain this anomaly is that returns on Monday are expected to be different, given that they are across Friday-end-to-Monday-morning, a much longer period than any other day, and hence with more information. This is why this departure from market efficiency is also sometimes called the weekend effect.

The alternative prescriptions about the behaviour of markets based on various sources and forms of investor irrationality are collectively known as behavioral finance. It implies that (i) the estimation of expected returns based on methods such as the capital asset pricing model is unreliable, and (ii) there could be many profitable trading strategies based on the collective irrationality of the markets.

Departures from market efficiency, or the delays in markets reaching equilibrium (and thus efficiency) leave scope for active portfolio managers to exploit mispricing in securities to their benefit. A number of investment strategies are tailored to profit from such phenomena, as we would see in later chapters.

CHAPTER 5: Financial Analysis and Valuation

5.1 Introduction

Investments in capital markets primarily involve transactions in shares, bonds, debentures, and other financial products issued by companies. The decision to invest in these securities is thus linked to the evaluation of these companies, their earnings, and potential for future growth. In this chapter we look at one of the most important tools used for this purpose, Valuation. The fundamental valuation of any asset (and companies are indeed assets into which we invest) is an examination of future returns, in other words, the cash flows expected from the asset. The 'value' of the asset is then simply what these cash flows are worth today, i.e., their *present discounted value*. Valuation is all about how well we predict these cash flows, their growth in future, taking into account future risks involved.

5.2 The Analysis of Financial Statements

A company's financial statements provide the most accurate information to its management and shareholders about its operations, efficiency in the allocation of its capital and its earnings profile. Three basic accounting statements form the backbone of financial analysis of a company: the income statement (profit & loss), the balance sheet, and the statement of cash flows. Let us quickly summarize each of these.

5.2.1 *Income Statement (Profit & Loss)*

A profit & loss statement provides an account of the total revenue generated by a firm during a period (usually a financial year or a quarter), the expenses involved and the money earned. In its simplest form, revenue generation or sales accrues from selling the products manufactured, or services rendered by the company. Operating expenses include the costs of these goods and services and the costs incurred during the manufacture. Beyond operating expenses are interest costs based on the debt profile of the company. Taxes payable to the Government are then debited to provide the Profit After Tax (PAT) or the net income to the shareholders of the company.

Actual P&L statements of companies are usually much more complicated than this, with so-called 'other income' (income from non-core activities), 'negative' interest expenses (from cash reserves with the company), preferred dividends, and non-recurring, exceptional income or expenses. The example given below is that of a large company in the Pharmaceutical sector over the period 2006-2008.

Illustration 5.1

Income Statement (US$M)	2006	2007	2008
Net sales	16,380	21,340	33,565
Cost of sales	(5,332)	(6,584)	(8,190)
SG&A	(1,408)	(1,771)	(2,738)
Research & development	(1,534)	(2,440)	(2,725)
Other operating items	(3,650)	(4,620)	(5,369)
EBIT	4,457	5,926	14,543
Total other non-operating items	543	1,336	305
Associates	0	0	0
Net interest income/expense	869	1,072	1,146
Exceptional items	0	0	0
Pretax profit	5,869	8,334	15,994
Taxation	(239)	67	(485)
Minority interest	3	(559)	(640)
Preferred dividends	0	0	0
Net extraordinary items	100	0	0
Reported net income	5,733	7,843	14,869

5.2.2 *The Balance Sheet*

Assets owned by a company are financed either by equity or debt and the balance sheet of a company is a snapshot of this capital structure of the firm at a point in time; the sources and applications of funds of the company.

A company owns fixed assets (machinery, and other infrastructure), current assets (manufacturing goods in progress, money it expects to receive from business partners—receivables, inventory etc.), cash and other financial investments. In addition to these three, a company could also own other assets which carry value, but are not directly marketable, like patents, trademarks, and 'goodwill'—value not linked to assets, but realized from acquisitions.

These assets are financed either by the company's equity (investments by shareholders) or by debt. The illustrative example shown below is the balance sheet of a large Pharmaceutical company.

Illustration 5.2

Balance Sheet (US$m)	2006	2007	2008
Cash and marketable securities	15,628	14,106	17,290
Accounts receivable	3,609	6,789	14,177
Inventory	5,117	6,645	7,728
Other current assets	2,471	2,653	5,079
Current assets	26,826	30,192	44,274
Net tangible fixed assets	8,977	10,122	11,040
Total financial assets	3,237	2,239	2,659
Net goodwill	507	697	1,729
Total assets	39,547	43,250	59,701
Accounts payable	2,279	2,966	3,722
Short-term debt	0	0	0
Total other current liabilities	1,236	80	2,651
Current liabilities	3,515	3,046	6,373
Long-term debt	18,747	11,144	1,436
Total other non-current liabilities	1,053	895	92
Total provisions	0	0	0
Total liabilities	23,314	15,085	7,901
Minority interest – accumulated	332	438	1,886
Shareholders' equity	15,902	27,728	49,915
Shareholders' funds	16,233	28,166	51,800
Liabilities and shareholders' funds	39,547	43,250	59,701

5.2.3 *Cash Flow Statement*

The cash flow statement is the most important among the three financial statements, particularly from a valuations perspective. As the name implies, such a statement is used to track the cash flows in the company over a period. Cash flows are tracked across operating, investing, and financing activities. Cash flows from operations include net income generation adjusted for changes in working capital (like inventories, receivables and payables), and non-core accruals (like depreciation, etc). A firm's investment activities comprise fixed, and current assets (capital- and operating expenditure), sometimes into other firms (like an acquisition), and generally represent negative cash flows. Cash flows in financing activities are the net result of the firm's borrowing, and payments during the period. The sum total of cash flows from these three heads represents the net change in cash balances of the firm over the period.

Cash generation from operating activities of the firm, when adjusted for its capital expenditure represent the 'free cash' available to it, for potential investment activities, acquiring other firms or businesses, or distribution among its shareholders. As we will see in later topics, free cash flows are the key to calculating the so-called intrinsic value of an asset in any discounted valuation model. Our illustrative example below shows the cash flow statement (and free cash flows) of a large pharmaceutical company over the period 2006-2008.

Illustration 5.3

Cash Flow (US$M)	2006	2007	2008
Reported net income	5,733	7,843	14,869
Preferred dividends	0	0	0
Minority interest	(3)	559	640
Depreciation and amortization	610	813	969
Cash tax adjustment	75	(511)	(1,337)
Total other operating cash flow	(1,365)	(2,156)	(753)
Net change in working capital	(3,177)	(4,154)	(9,340)
Cash from operations	1,872	2,394	5,048
Capital expenditure	(3,387)	(2,000)	(1,995)
Net acquisitions/disposals	3,511	1,367	(5,242)
Total other investing cash flows	634	1,272	1,177
Cash from investing activities	758	639	(6,060)
Change in borrowings	805	(1,742)	768
Equity raised/share buybacks	0	0	0
Dividends paid	(793)	(2,629)	(18)
Total other financing cash flows	(156)	(127)	(88)
Cash from financing activities	(144)	(4,498)	661
Change in cash	3,518	(1,465)	(352)
Free cash flow	(1,514)	394	3,052

5.3 Financial Ratios (Return, Operating and, Profitability Ratios)

Financial ratios are meaningful links between different entries of financial statements, as by themselves the financial entries offer little to examine a company. In addition to providing information about the financial health and prospects of a company, financial ratios also allow a company to be viewed, in a relative sense, in comparison with its own historical performance, others in its sector of the economy, or between any two companies in general. In this section we examine a few such ratios, grouped into categories that allow comparison of size, solvency,

operating performance, growth profile and risks. The list below is by no means exhaustive, and merely serves to illustrate a few of the important ones.

5.3.1 *Measures of Profitability: RoA, RoE*

Return on Assets (RoA) in its simplest form denotes the firm's ability to generate profits given its assets :

RoA = (Net Income + Interest Expenses)*(1- Tax Rate) / Average Total Assets

Return on Equity (RoE) is the return to the equity investor :

RoE = Net Income / Shareholder Funds

Sometimes this ratio is also calculated as RoAE, to account for recent capital raising by the firm

Return on Average Equity = Net Income / Average Shareholder Funds

Return on Total Capital = Net Income + Gross Interest Expense / Average total capital

5.3.2 *Measures of Liquidity*

Short-term liquidity is imperative for a company to remain solvent. The ratios below get increasingly conservative in terms of the demands on a firm to meet near-term payables.

Current ratio = Current Assets / Current Liabilities

Quick Ratio = (Cash + Marketable Securities + Receivables) / Current Liabilities

Acid test ratio = (Cash + Marketable Securities) / Current Liabilities

Cash Ratio = (Cash + Marketable Securities) / Current Liabilities

5.3.3. *Capital Structure and Solvency Ratios*

Total debt to total capital = (Current Liabilities + Long-term Liabilities) / (Equity + Total Liabilities)

Long-term Debt-Equity = Long-term Liabilities / Equity

5.3.4 *Operating Performance*

Gross Profit Margin = Gross Profit / Net Sales

Operating Profit Margin = Operating Income / Net Sales

Net Profit Margin = Net Income / Net Sales

5.3.5 *Asset Utilization*

These ratios look at the effectiveness of a firm to utilize its assets, especially its fixed assets. A high turnover implies optimal use of assets. In addition to the two below there are others like Sales to inventories, and Sales to Working capital.

Total Asset Turnover = Net Sales / Average Total Assets

Fixed Asset Turnover = Net Sales / Average Net Fixed Assets

There are many other categories, like the 'common size' ratios, which serve to present the company in terms of one of its own denominators, like Net Sales, or the market capitalization; and others that specifically look at the risk aspect of things (business, financial, and liquidity).

We shall take a look at another two categories, the market measures, and valuation ratios, after the discussion on valuations.

5.4 The valuation of common stocks

In chapter 3, we examined a few of the major valuation methods for fixed income-generating assets. Using financial statements and ratios, we now examine some of the concepts relating to share valuations and to be more specific, we will deal with valuation of common stocks. Common shareholders are the owners of the firm, and as such are the final stakeholders in its growth, and risks; they appoint the management to run its day-to-day affairs and the Board of Directors to oversee the management's activities. The cash flows (return) to common shareholders from the company are generally in the form of current and future dividends distributed from the profits of the firm. Alternatively, an investor can always sell her holdings in the market (secondary market), get the prevailing market price, and realize capital appreciation if the returns are positive.

We now examine the valuation of common shares in some detail. As mentioned above, the valuation of any asset is based on the present value of its future cash flows. Such a methodology provides what is called the *'intrinsic'* value of the asset—a common stock in our case. The problem of valuing the stock then translates into one of predicting the future free cash flow profile of the company, and then using the appropriate discount factor to measure what they are worth today. The appropriately named discounted-cash flow technique is also referred to as absolute valuation, particularly when compared to another widely-followed approach in valuation, called relative valuation.

Relative valuation looks at pricing assets on the basis of the pricing of other, similar assets—instead of pricing them independently—the core assumption being that assets with similar earnings and growth profile, and facing the same risks ought to be priced comparably. Two stocks in the same sector of the economy could thus be compared, and the same sector (and its stocks) across countries. The discussion on relative valuation follows that of absolute or intrinsic valuation.

5.4.1 *Absolute (Intrinsic) Valuation*

Intrinsic value or the fundamental value refers to the value of a security, which is intrinsic to or contained in the security itself. It is defined as the present value of all expected cash flows to the company. The estimation of intrinsic value is what we would be dealing with in details in this chapter.

5.4.1.1 *Discounted Cash Flows*

The discounted cash flow method values the share based on the expected dividends from the

shares. The price of a share according to the discounted cash flow method is calculated as under:

$$P_0 = \sum_{t=1}^{\infty} \frac{Div_t}{(1+r)^t}$$

Since the profits of the firm are not certain, the actual future dividends are not known in advance. However, the market forms an expectation of the future dividends and the value of a share is the present value of expected future dividends of the company. It can be shown that the formula can be seen as an extension of the formula $P_0 = \frac{Div_1 + P_1}{(1+r)}$.

As explained above, we can write the share price at the end of the year 1 as a function of the 2nd year dividend and price of share at the end of the year 2. Or,

$$P_1 = \frac{Div_2 + P_2}{(1+r)}$$

Similarly,

$P_2 = \frac{Div_3 + P_3}{(1+r)}$ and so on.

Putting the values of P_1, P_2, P_3, P_4, we can write:

$$P_0 = \frac{Div_1 + P_1}{(1+r)} = \frac{Div_1}{1+r} + \frac{Div^2}{(1+r)^2} + \frac{Div^3}{(1+r)^3} + ... + \frac{Div_N}{(1+r)^N} + \frac{P_N}{(1+r)^N}$$

Now when N tends to infinity, $(1+r)^N$ tends to infinity and the value of $\frac{P_N}{(1+r)^N}$ tends to zero and therefore may be ignored. So the current share price (P_0) can be written as:

$$P_0 = \sum_{t=1}^{\infty} \frac{Div_t}{(1+r)^t}$$

5.4.1.2 *Constant Dividend Growth*

Let us see a special case of the above model when it is assumed that amount paid as dividends grows at a constant rate (say g) every year. In this case, the cash flows in various years will be as under:

Year	Cash Flow
0	$-P_0$
1	Div_1
2	$Div_2 = Div_1*(1+g)$
3	$Div_3 = Div_2*(1+g) = Div_1*(1+g)^2$
4	$Div_4 = Div_3*(1+g) = Div_2*(1+g)^2 = Div_1*(1+g)^3$

In this circumstance, where the dividend amount grows at a constant rate, the constant dividend

growth model states that the share price can be obtained using the simple formula:

$$P_0 = \frac{Div_1}{r - g}$$

This formula can be used only when the expected rate of return (r) is greater than the growth rate (g). Otherwise, the present value of the growing perpetuity will reach infinite. This is even true in real world. It is not possible for a stock's dividend to grow at a rate g, which is greater than r for infinite period. It can only be for a limited number of years. This model is not applicable in such cases.

Example: RNL has paid a dividend of Rs. 10 per share last year (D_0) and it is expected to grow at 5% every year. If an investor's expected rate of return from RNL share is 7%, calculate the market price of the share as per the dividend discount model.

Answer: The following are given:

Div_0 = 10; g = 5% or 0.05; r = 7% or 0.07.

$$Div_1 + Div_0 * (1 + g) = 10 * 1.05 = 10.50$$

$$P_0 = \frac{Div_1}{r - g} = \frac{10.50}{0.07 - 0.05} = \frac{10.50}{0.02} = 525$$

The market price of RNL share as per the dividend discount model with constant growth rate is Rs. 525.

If we know the market price of the share, the dividend amount and the dividend growth rate, then we can compute the expected rate of return (r) by using the following formula:

$$r = \frac{Div_1}{P_0} + g$$

5.4.1.3 *Present Value of Growth opportunities (PVGO)*

One can split the value of the shares as computed in the constant growth model into two parts – the present value of the share assuming level stream of earnings (a level stream of earnings is simply the current income extrapolated into the future, with no growth; in which case, there's no need to retain any of the earnings) and the present value of growth opportunities. The value of growth opportunities is positive if the firm (and the market) believes that the firm has avenues to invest which will generate a return that is more than the market expected rate of return. Now when the firm's income potential from additional investment is more than the market expected rate of return, then for every penny re-invested (plowbacked rather than distributed as dividend) will generate a return that is higher than the market expectation. The

value of such excess return is referred to as present value of growth opportunities.

PVGO = Share Price – Present value of level stream of earnings

= Share price – EPS / r

The growth in the future dividend arises because the firms, instead of distributing 100% of the earnings as dividends, plowbacks and invests certain portion of the current year profit on projects whose yield will be greater than the market expected rate of return.

The growth rate in dividend (g), equals, the Plowback ratio * ROE.

5.4.1.4 *Discounted Free-cash flow valuation models*

Using the above concepts, we are now in a position to look at valuation using cash flows, with the discounted free cash flow model. We first determine the value of the enterprise and then value the equity by deducting the debt value from the firm value. Thus:

Market value of equity (V_0) = Value of the firm + Cash in hand – Debt Value

The price of the share (P_0) is the market value of the equity divided by the number of shares outstanding.

It is simple to calculate the debt value since the payments to be made to debt holders is predetermined and certain. However, the real problem lies with determining the value of the firm. As per the discounted free cash flow model, the value of a firm is the present value of the future free cash flow of the firm. The discounting rate is the firms weighted average cost of capital (WACC) and not the market expected rate of return on equity investment. WACC is the cost of capital that reflects the risk of the overall business and not the risk associated with the equity investment alone. WACC is calculated using the following formula:

$$WACC = r_D\,(1 - T) * \frac{D}{D+E} + r_E * \frac{E}{D+E}$$

where

r_D and r_E is the expected rate of return on debt and equity

T = Income Tax Rate

D = the market value of debt ; E = the market value of equity

The firm value (V_0) is calculated using the following formula:

$$V_0 = \frac{FCF_1}{1 + r_{wacc}} + \frac{FCF_2}{(1 + r_{wacc})^2} + \frac{FCF_3}{(1 + r_{wacc})^3} + \ldots + \frac{FCF_N}{(1 + r_{wacc})^N} + \frac{(Terminal\ Value_N)}{(1 + r_{wacc})^N}$$

The terminal value at year N is often computed by assuming that the FCF will grow at a constant growth rate beyond year N, i.e.

$$Terminal\ Value_N = \frac{FCF_{N+1}}{((r)_{WACC} - g_{FCF})} = \frac{FCF * (1 + g_{FCF})}{((r)_{WACC} - g_{FCF})}$$

where g_{FCF} is the expected growth rate of the firms free cash flow

What is free cash flow (FCF)? The free cash measures the cash generated by the firm that can be distributed to the equity shareholders after budgeting for capital expenditure and working capital requirements. While computing FCF, we assume that the firm is a 100% equity owned company and hence we do not consider any payment to debt or equity holders while calculating the free cash flow. Thus the formula for computing FCF is:

$$Terminal\ VFCF = EBIT * (1 - T) + Depn - Capital\ Expenditure - Increase\ in\ Working\ Capital$$

where T in the tax rate.

We start with EBIT since we do not consider cash outflow in the form of interest payments. Depreciation lowers the EBIT but is added back since it is a non-cash expenditure (does not result in cash payments). Since the firm has to incur any planned capital expenditure and has to finance any working capital requirement before distributing the profits to the shareholders the same is deducted while calculating the free cash flows.

5.4.2 *Relative Valuation*

Relative valuation models do calculate the share price but they are generally based on the valuation of comparable firms in the industry. Various valuation multiples such as price-earning ratio, enterprise value multiples, etc. are used by the finance professionals which depends on the industry, current economic scenario, etc. Most of these models are generally used for evaluation purpose as to whether a particular stock is overvalued or undervalued and less for actual valuation of the shares.

As discussed in the first chapter, the face value or nominal value of a share is the price printed on the share certificate. One should not confuse a share's nominal value with the price at which the company issues shares to the public. The price at which a company issues shares may be more or less than the face value. The issue price is generally more than the face value and the difference between the issue price and the face value is called as share premium.

Market price is the price at which the share is traded in the market. It is determined by the demand and supply of the share in the market and depends on the market (buyers and sellers) estimation of the present value of all future cash flows to the company. In an efficient market, we assume that the market is able to gather all information about the company and price accordingly. Market capitalization of a company is the total value of all shares of the company and is calculated by multiplying the market price per share with the number of shares outstanding in the market.

The book value or carrying value in accounting, is the value of an asset according to its balance sheet account balance. For assets, the value is based on the original cost of the asset less any depreciation, amortization or impairment costs made against the asset. Book value per share is calculated by dividing the net assets of the company with the number of shares outstanding. The net asset of the company is the values of all assets less values of all liabilities outstanding in the books of accounts.

5.4.2.1 *Earning per Share (EPS)*

Earning per share is the firms' net income divided by the average number of shares outstanding during the year.

Calculated as:

$$EPS = \frac{Net\ Proift - Dividend\ on\ Preference\ Shares}{Average\ number\ of\ shares\ outstanding\ during\ the\ year}$$

5.4.2.2 *Dividend per Share (DPS)*

Dividends are a form of profit distribution to the shareholders. The firm may not distribute the entire income to the shareholders, but decide to retain some portion of it for financing growth opportunities. Alternatively, a firm may pay dividends from past years profit during years where there is insufficient income. In this case, the dividends amount will be higher than the earnings. The dividend per share is the amount that the firm pays as dividend to the holder of one share i.e. total dividend / number of shares in issue.

The dividend payout ratio (DPR) measures the percentage of income that the company pays out to the shareholders in the form of dividends. The formula for calculating DPR is:

$$DPR = \frac{Dividends}{Net\ Income} = \frac{DPS}{EPS}$$

Retention ratio is the opposite of dividend payout ratio and measures the percentage of net income not paid to the shareholders in the form of dividends. It is nothing but (1-DPR).

Example: The following is the figure for Asha International during the year 2008-09:

Net Income: Rs. 1,000,000

Number of equity shares (2008): 150,000

Number of equity shares (2009): 250,000

Dividend paid: Rs. 400,000

Calculate the earnings per share (EPS), dividend per share (DPS), dividend payout ratio and

retention ratio for Asha International.

Answer:

$$Average\ number\ of\ shares = \frac{Opening + closing}{2} = \frac{150{,}000 + 250{,}000}{2} = 200{,}000$$

$$EPS = \frac{Net\ Income}{Average\ Number\ of\ shares} = \frac{1{,}000{,}0000}{200{,}000} = 5$$

$$DPS = \frac{Dividends}{Average\ Number\ of\ shares} = \frac{4{,}00{,}000}{200{,}000} = 2$$

$$DPR = \frac{DPS}{EPS} = \frac{2}{5} = 0.4\ or\ 40\%$$

Retention Ratio = 1- DPR = 0.6 or 60%

5.4.2.3 *Price-earnings ratio (P/E Ratio)*

Price earning ratio for a company is calculated by dividing the market price per share with the earnings per share (EPS).

$$Price\ Earnings\ Ratio = \frac{Market\ price\ per\ share}{Annual\ earning\ per\ share}$$

The earning per share is usually calculated for the last one year. Sometimes, we also calculate the PE ratio using the expected future one-year return. In such case, we call forward PE or estimated PE ratio.

Example: Stock XYZ, whose earning per share is Rs. 50 is trading in the market at Rs. 2000. What is the price to earnings ratio for XYZ?

Answer:

$$Price\ Earnings\ Ratio = \frac{Market\ price\ per\ share}{Annual\ earning\ per\ share} = \frac{2000}{50} = 40$$

We cannot draw any conclusion as to whether a stock is undervalued or overvalued in the market by just considering the PE ratio. A higher PE ratio implies that the investors are paying more for each unit of net income, which implies that the investors are optimistic about the future performance (or future growth rate) of the company. Stocks with higher PE ratio are also called growth firms and stocks with lower PE ratio are called as income firms.

5.4.2.4 *Price-Book Ratio*

The price-book ratio is widely used as a conservative measure of relative valuation of an asset, where the assets of the firm are valued at book. Investors also widely use the ratio to judge whether the stock is undervalued or overvalued, as it's less susceptible to fluctuations than the

PE ratio. The formula to calculate the ratio is:

Price-book ratio = Market price of the share / Book Value per share.

5.4.2.5 *Return on Equity*

Return on equity measures profitability from the equity shareholders point of view. It is the return to the equity shareholders and is measured by the following formula:

$$ROE = \frac{Net\ Income\ after\ Tax - Preferred\ Dividends}{Average\ Shareholder\ Equity\ Excluding\ Preferred\ Share\ Capital}$$

Example: XYZ Company net income after tax for the financial year ending 31st March, 2009 was Rs. 10 million and the equity share capital as on 31st March, 2008 and 31st March 2009 was Rs. 80 million and Rs. 120 million respectively. Calculate the return on equity of XYZ company for the year 2008-09.

Answer:

$$Average\ Equity = \frac{Opening\ Equity + Closing\ Equity}{2} = \frac{80 + 120}{2} = 100\ million$$

$$Return\ on\ Equity = \frac{Net\ Profit\ after\ Tax}{Average\ Equity} = \frac{10}{100} = 0.10\ or\ 10\%$$

5.4.2.6 *The DuPont Model*

The Du Pont model is widely used to decide the determinants of return profitability of a company, or a sector of the economy. Returns on shareholder equity are expressed in terms of a company's profit margins, asset turn, and its financial leverage.

DuPont Model breaks the Return on equity as under:

RoE = Return on Equity

= Net Profits/Equity

= Net Profits/Sales * Sales/Assets * Assets/Equity

= Profit Margin * Asset Turnover * Financial Leverage

The first component measures the operational efficiency of the firm through its net margin ratio. The second component, called the asset turnover ratio, measures the efficiency in usage of assets by the firm and the third component measures the financial leverage of the firm through the equity multiplier. The analysis reflects a firms' efficiency in different aspects of business and is widely used now for control purpose. It shows that the firm could improve its RoE by a combination of profitability (higher profit margins), raising leverage (by raising debt), by using its assets better (higher asset turn) or a combination of all three.

The DuPont analysis could be easily extended to ascertain a sector's profitability metrics for comparability, or, for that matter, an entire market.

5.4.2.7 *Dividend Yield*

Dividend yield is the ratio between the dividend paid during the last 1-year period and the current price of the share. The ratio could also be used with the forward dividend yield instead—expected dividends, for either the next 12 months, or the financial year.

Example: ABC Company paid a dividend of Rs. 5 per share in 2009 and the market price of ABC share at the end of 2009 was Rs. 25. Calculate the dividend yield for ABC stock.

Answer:

$$Dividend\,Yield = \frac{Last\ year\ dividend}{Current\,Price\ per\ share} = \frac{5}{25} = 0.20\ or\ 20\%$$

5.4.2.8 *Return to Investor*

The return what the investor earns during a year by holding the share of a company is not equal to the dividend per share or the earnings per ratio. An investor's earning is the sum of the dividend amount that he received from the company and the change in the market price of the share. The investment amount is equal to the market price of the share at the beginning of the year. An investor's return can be calculated using the following formula:

$$Expected\ Return(r) = \frac{Dividends + \Delta\,(market\ price\,of\ the\,share)}{Opening\,Market\,Price}$$

Example: The share price of PQR Company on 1st April 2008 and 31st March 2009 is Rs. 80 and Rs. 84 respectively. The company paid a dividend of Rs. 6 for the year 2008-09. Calculate the return for a shareholder of PQR Company in the year 2008-09.

Answer:

$$Expected\ Return(r) = \frac{Dividends + \Delta\,(market\ price\,of\ the\,share)}{Opening\,Market\,Price} = \frac{6 + (84 - 80)}{80} = \frac{10}{80} = 12.5\%$$

If we write the dividends during the year as Div_1, the price of the share at the beginning and at the end of the year as P_0 and P_1 respectively, we can write the above formula as:

$$r = \frac{Div_1 + P_1 - P_0}{P_0}$$

This can be re-written as:

$$P_0 = \frac{Div_1 - P_1}{(1 + r)}$$

This implies that given the expected rate of return for an investor, the price of a share can be calculated based on the investor expectation of the future dividends and the future share price. We have already learned in the previous chapter about the factors that affect the expected rate of returns and how one can calculate the expected rate of returns (e.g. using CAPM). Now the question arises what determines the next year price (P_1) of a share.

5.5 Technical Analysis

Our final approach to valuation is also considered the most controversial, with the numbers of believers balancing those who find fault with the methodology. Technical analysis involves making trading decisions by studying records or charts of past stock prices and volume, and in the case of futures, open interest.

The technical analysts do not attempt to measure a security's intrinsic value but believe in making short-term profit by analyzing the volume and price patterns and trends. Technical analysts use statistical tools like time series analysis (in particular trend analysis), relative strength index, moving averages, regressions, price correlations, etc. The field of technical analysis is based on the following three assumptions.

a) The market discounts everything: Technical analysts believe that the market price takes into consideration the intrinsic value of the stocks along with broader economic factors and the market psychology. Therefore, what is important is an analysis of the price movement that reflects the demand and supply of a stock in the short run.

b) Price moves in trends: Trends are of three types, viz. uptrend, downtrend and horizontal trend. Technical analysts believe that once trends are established in the prices, the price moves in the same direction as the trends suggests.

c) History tends to repeat itself: This assumption leads to a belief that current investors repeat the behavior of the investors that preceded them and therefore recognizable price patterns can be observed if a chart is drawn.

There are various concepts that are used by technical analysts like support prices, resistance levels, breakouts, momentum, etc. These concepts can be heard very often in business channels and business newspapers. Supports refer to the price level through which a stock price seldom falls and resistance is the price level through which a stock seldom surpasses. Breakout refers to situation when the price actually falls below the support level or rises above the resistance level. Once a breakout occurs, the role is reversed. If the price increases beyond the resistance level, the resistance level becomes the support level and when the price falls below the support level, the support level becomes the new resistance level for the stock. Momentum refers to the rate at which price of a stock changes.

5.5.1 *Challenges to Technical Analysis*

There are many questions, primarily raised by fundamental analysts, about the assumptions of technical analysis. While it is understandable that price movements are caused by the interaction of supply and demand of securities and that the market assimilates this information (as mentioned in the first assumption), there is no consensus on the speed of this adjustment or its extent. In other words, while prices may react to changes in demand-supply and other market dynamics, the response could easily differ across securities, both in the time taken, and the degree to which prices change. Other objections to technical analysis arise from Efficient Markets Hypothesis, which we have seen in Chapter 4. Proponents of the EMH aver that market efficiency would preclude any technical trading patterns to repeat with any predictable accuracy, rendering the profitability of most such trading rules subject to chance. Further, the success of a trading rule could also make it crowded, in the sense that most technical traders follow a small set of rules (albeit with possibly different parameterizations), speeding up the adjustment of the market, and thus reducing the potential gains. Finally, technical analysis involves meaningful levels of subjectivity-interpretations may vary widely on the same pattern of stock, or index prices-which also hinders systematic reasoning and extensibility across different securities.

CHAPTER 6: Modern Portfolio Theory

6.1 Introduction

Understanding the risky behaviour of asset and their pricing in the market is critical to various investment decisions, be it related to financial assets or real assets. This understanding is mostly developed through the analysis and generalization of the behaviour of individual investors in the market under certain assumptions. The two building blocks of this analysis and generalization are (i) theory about the risk-return characteristics of assets in a portfolio (portfolio theory) and (ii) generalization about the preferences of investors buying and selling risky assets (equilibrium models). Both these aspects are discussed in detail in this chapter, where our aim is to provide a brief overview of how finance theory treats stocks (and other assets) individually, and at a portfolio level. We first examine the modern approach to understanding portfolio management using the trade-off between *risk* and *return* and then look at some equilibrium asset-pricing models. Such models help us understand the theoretical underpinning and (hopefully predict) the dynamic movement of asset prices.

6.2 Diversification and Portfolio Risks

The age-old wisdom about not putting "all your eggs in one basket" applies very much in the case of portfolios. Portfolio risk (generally defined as the *standard deviation* of returns) is not the weighted average of the risk (standard deviation) of individual assets in the portfolio. This gives rise to opportunities to eliminate the risk of assets, at least partly, by combining risky assets in a portfolio. To give an example, consider a hypothetical portfolio with say, ten stocks. Each of these stocks has a risk profile, a simple and widely used indicator of which is the standard deviation of its returns. Intuitively, the overall risk of the portfolio simply ought to be an aggregation of individual portfolio risks, in other words, portfolio risk simply ought to be a weighted average of individual stock risks. Our assertion here is that the risk of the portfolio is usually much lower. Why? As we shall see in the discussion here, this is largely due to the interrelationships that exist between stock price movements. These so-called covariances between stocks, could be positive, negative, or zero. An example of two IT services stocks, reacting favourably to a depreciation in the domestic currency—as their export realizations would rise in the domestic currency—is one of positive covariance. If however, we compare one IT services company with another from the metals space, say steel, which has high foreign debt, then a drop in the share price of the steel company (as the falling rupee would increase the debt-service payments of the steel firm) and rise in share price of the IT services company, would provide an example of negative covariance. It follows that we would expect to have zero covariance between stocks whose movements are not related.

Let us now examine why and how portfolio risk is different from the weighted risk of constituent assets. Assume that we have the following two stocks, as given in table 6.1 here, and then assume further that the returns of the two hypothetical stocks behave in opposite directions. When A gives high returns, B does not and vice versa. We know this is quite possible, as in our earlier comparison of a software company with a commodity play. For a portfolio with 60% invested in A, the portfolio standard deviation becomes zero. Although the two stocks involved were risky (indicated by the standard deviations), a portfolio of the two stocks with a certain weight may become totally risk-free. The table below shows a portfolio of the two stocks with weight of Stock A (W) being 0.6 and weight of stock B being (1-0.6) or 0.4. It can be seen that irrespective of the market condition, the portfolio gives a return of 10%.

Table 6.1 : Portfolio of Two Assets

Market Condition	Return on A	Return on B	Return on portfolio (W= 0.6)
Good	16%	1%	10%
Average	10%	10%	10%
Poor	4%	19%	10%
Standard deviation	5%	7%	0%
Correlation	-1.0		

Why does the portfolio standard deviation go to zero? Intuitively, the negative deviation in the returns of one stock is getting offset by the positive deviation in the other stock. Let us examine this in a somewhat more formal and general context.

Let us assume that you can form portfolios with two stocks, A & B, having the following characteristics:

Return on Stock $A = R_A$
Mean return on stock $A = \overline{R_A}$
Std. deviation of the return of stock $A = \sigma_A$
Return on Stock $B = R_B$
Mean return on stock $B = \overline{R_B}$
Std. deviation of the return of stock $B = \sigma_B$

The total available amount that can be invested, is Re. 1. The proportional investments in each of the stocks are as below,

Stock A = W

Stock B = (1 - W)

where W is between 0 and 1.

Given this information, we can show that

$$\sigma_p^2 = W^2\,\sigma_A^2 + (1-W)^2\sigma_B^2 + 2W(1-W)\,Cov\,(A, B)$$

That is, we would show that the variance of our portfolio, as denoted by the left hand side of this equation, is dependent on the variance of stock A, that of stock B, and a third term, called Cov(A,B). It is this third term that denotes the interrelationship between the two stocks. As discussed before, such a relation could be positive, negative or zero. In cases with negative covariance, portfolio variance would actually be lower than the (weighted) sum of stock variances! In other words, since variance (or standard deviation) is the primary metric of risk measurement, then we can say that the risk of the portfolio would be lower than individual stocks considered separately.

So here is how we go about deriving this expression:

With these investments the portfolio return is,

$$R_P = W\,R_A + (1-W)R_B \qquad (1)$$

$$\overline{R_P} = W\,\overline{R_A} + (1-W)\,\overline{R_B} \qquad (2)$$

where, R_P = Return on the portfolio and $\overline{R_P}$ = Mean return on the portfolio. Let, σ_P = Std.deviation of portfolio returns, then the variance of the portfolio returns can be derived as,

$$\sigma_P^2 = \frac{1}{n}\sum\left(R_p - \overline{R}_P\right)^2 \qquad (3)$$

with a straightforward rearrangement and substitution for R_P = and $\overline{R_P}$ = from the expressions (1) and (2), the portfolio variance is,

$$= W^2\,\frac{1}{n}\sum\left(R_A - \overline{R_A}\right)^2 + (1-W)^2\,\frac{1}{n}\sum\left(R_B - \overline{R_B}\right)^2 + 2W\,(1-W)\frac{1}{n}\sum\left(R_A - \overline{R_A}\right)\left(R_B - \overline{R_B}\right)$$

We know that,

$$\frac{1}{n}\sum\left(R_A - \overline{R_A}\right)^2 = \sigma_A^2\ ,$$

$$\frac{1}{n}\sum\left(R_B - \overline{R_B}\right)^2 = \sigma_B^2$$

$$\frac{1}{n}\sum\left(R_A - \overline{R_A}\right)\left(R_B - \overline{R_B}\right) = Cov\,(A,B)$$

The covariance can be regarded as a measure of how much two variables change together from their means. It can also be expressed as, $Cov\ (A,B) = \rho_{A,B}\ \sigma_A\ \sigma_B$, where $\rho_{A,B}$ is the correlation between returns of stocks A and B. Therefore, if the correlation is positive and the stocks have high standard deviations, then the covariance would be positive and large. It would be negative if the correlation is negative.

Substituting these, the portfolio variance can be expressed as,

$$\sigma_P^2 = W^2\ \sigma_A^2 + (1-W)^2\ \sigma_B^2 + 2W\ (1-W)\ Cov\ (A,B)\ .\qquad (4)$$

Equation (4) suggests that the total portfolio variance comprises the weighted sum of variances and weighted sum of the covariances too. Let us examine the insights from expression (4) for the variance of combinations of stocks (or any other asset) with varying level of correlations.

Given the nature of the return relationship between the A and B (in Table 6.1), it is easy to see that their correlation is -1.0. For the portfolio of stock A and B, the risk becomes zero, when weight of stock A (W) = 0.6.

Table 6.2 : Decomposition of the Total Portfolio Variance

Element of variance	Proportion	Sigma	Var/Covar
Var – A	0.6	0.05	0.000864
Var – B	0.4	0.07	0.000864
Covar			-0.001728

Although the two stocks involved were risky (indicated by the standard deviations), one of their possible combinations becomes totally risk-free. The variances of the individual stocks are offset by their covariance in the portfolio (as shown in Table 6.2).

When the correlation between the two stocks is 1.0, the standard deviation of the portfolio shall be just a weighted average of the standard deviation of the two stocks involved. This implies that a portfolio with two perfectly positively correlated stocks cannot reduce risk. The minimum portfolio standard deviation would always correspond to that of the stock with the least standard deviation.

The standard deviation of the portfolio with two uncorrelated (correlation = 0) stocks would always be lower than the case with correlation 1.0. It is possible to choose a value for W in such a way, so that the portfolio risk can be brought down below that of the least less risky stock involved in the portfolio.

However, in the real world the correlations almost always lie between 0 and 1. It is very straightforward to understand that the variance of portfolios with stocks having correlation in the 0 to 1 range would certainly be lower than those with stocks having correlation 1. At the same time, the variance of these portfolios shall be higher than those with uncorrelated stocks.

Let us examine if we can reduce the portfolio variance by combining stocks with correlation in the range of 0 to 1. Consider the two stocks, ACC and Dr. Reddy's Laboratories (DRL) with correlation around 0.21. As given in the following table, for a unique combination, the total variance (standard deviation) of the portfolio is less than that of ACC, the least risky stock. The details of the risk of this portfolio are provided in the following table.

Table 6.3 : Return and standard deviation of ACC, DRL and Portfolio

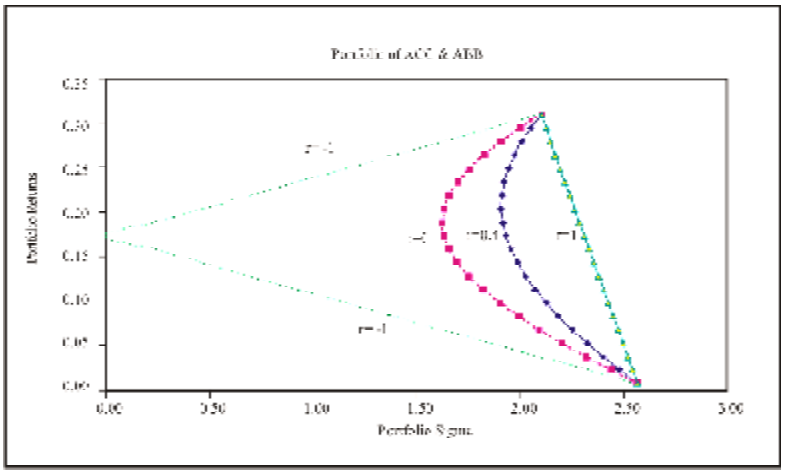
Year	ACC	DRL	Combinations		
			W=0.25	W=0.50	W=0.75
2001	1.24	1.5	1.44	1.37	1.31
2002	0.98	0.84	0.88	0.91	0.95
2003	1.41	1.42	1.42	1.42	1.41
2004	1.37	0.49	0.71	0.93	1.15
2005	1.61	1.2	1.30	1.41	1.51
Std. deviation	0.23	0.42	0.33	0.26	0.22
Average Return	1.322	1.09	1.148	1.206	1.264

Note: *W* represents the investment in ACC

This suggests that for certain values of W, the variance of the portfolio can be brought down by combining securities with correlation the range of 0 to 1.

A comparison of the behaviour (return-variance) of portfolios made with stocks of varying correlation is given in the following figure:

Figure 6.1 : Portfolio Risk and Return for Assets with Different Correlations



Note: the portfolio sigma is the standard deviation. The portfolios are created by using actual return data and assumed correlations, except 0.4, which is the actual correlation between the two stocks.

With these insights we can now examine the behaviour of portfolios with a larger number of assets.

6.2.1 *Portfolio variance - General case*

Let us assume that there are N stocks available for generating portfolios. Then, the portfolio variance (given by equation 4) can be expressed as,

$$\sigma_P^2 = \sum W_i^2 \, \sigma_i^2 + \sum \sum W_i W_i \sigma_{ij} \qquad (5)$$

where W_i is the proportional investment in each of the assets and σ_{ij} is the covariance between the pair of assets *i* and *j*. The double summation sign in the second part indicates that the covariance would appear for all possible combinations of *i* and *j*, except with themselves. For instance, if there are 3 stocks, there would be six covariance terms (1-2, 1-3, 2-1, 2-3, 3-1, 3-2).

To examine the characteristics of including a large number of stocks in the portfolio, assume that

$$W_i = \frac{1}{N}$$

$$\sigma_P^2 = \sum \frac{1}{N^2} \sigma_i^2 + \sum \sum \frac{1}{N^2} \sigma_{ij}$$

$$= \frac{1}{N} \sum \frac{1}{N} \sigma_i^2 + \frac{N-1}{N} \sum\sum \frac{1}{N(N-1)} \sigma_{ij}$$

$$= \frac{1}{N} \bar{\sigma}_i^2 + \frac{N-1}{N} \bar{\sigma}_{ij}$$

$$= \frac{1}{N} (\textit{Avg. Variance}) + \left(1 - \frac{1}{N}\right) (\textit{Avg. Covariance})$$

we create an equally weighted portfolio (equal investment in the stocks) of *N assets*. Then,

The expression just above gives the following insights:

1. **As N becomes a large number, the portfolio variance would be dominated by the covariances rather than variances. The variance of the individual stocks does not matter much for the total portfolio variance. This is one of the most powerful arguments for portfolio diversification.**

2. **Even by including a large number of assets, the portfolio variance cannot be reduced to zero (except when they are perfectly negatively correlated). The part of the risk that cannot be eliminated by diversifying through investments across assets is called the *market risk* (also called the *systematic risk* or *non-diversifiable risk*). This is something all of us commonly experience while investing in the market. One can reduce the risk of exposure to say HCL Technologies in the IT industry, by including other stocks from the IT industry, like Infosys technologies, Tech Mahindra and so on. If you consider the exposure to IT industry alone is troubling, you can also spread your investment to other industries like Banking, Telecom, Consumer products and so on. Going further, you can even invest across different markets, if you do not like to be exposed to anyone economy alone. But even after international diversification a certain amount of risk would remain. (international markets in the globalize world tend to move together). This is the market risk or systematic risk or non-diversifiable risk.**

3. **Given the above, it appears that the relevant risk of an asset is what it contributes to a widely-held portfolio, in other words, its covariance risk.**

6.3 Equilibrium Models: The Capital Asset Pricing Model

The most important insight from the analysis of portfolio risk is that a part of the portfolio variance can be diversified away (unsystematic or diversifiable risk) by selecting securities with less than perfect correlation. This along with the other insights obtained from the analysis would help us to understand the pricing of risky assets in the equilibrium for any asset in the capital market, under certain assumptions.

These additional assumptions required are as follows:

- **All investors are *mean-variance* optimizers. This implies that investors are concerned only about the mean and variance of asset returns. Investors would either prefer portfolios which offer *higher return for the same level of risk* or prefer portfolios which offer *minimum risk for a given level of return* (the indirect assumption of mean-variance investors is that all other characteristics of the assets are captured by the mean and variance).**
- **Investors have homogenous information about different assets. The well-organized financial markets have remarkable ability to digest information almost instantaneously (largely reflected as the price variation in response to sensitive information).**
- **Transaction costs are absent in the market and securities can be bought and sold without significant price impact.**
- **Investors have the same investment horizon.**

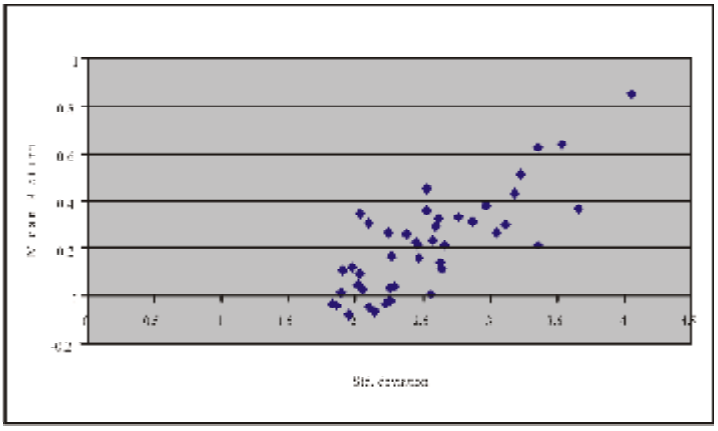
Given these assumptions, it is not impossible to see that substantive arbitrage opportunities would not exist in the market. For instance, if there is a portfolio which gives a higher return for same level of risk, investors would prefer that portfolio compared to the existing one.

In light of the behaviour of portfolio risk and the above assumptions, let us try to visualize what would be the relationship between risk and return of assets in the equilibrium.

6.3.1 *Mean-Variance Investors and Market Behaviour*

We can use a so-called mean-variance space to examine the aggregate behaviour of the market (as all investors are mean-variance optimizers, these are the only variables that matter). Evidently, all the assets in the market can be mapped on to a return-standard deviation space as follows.

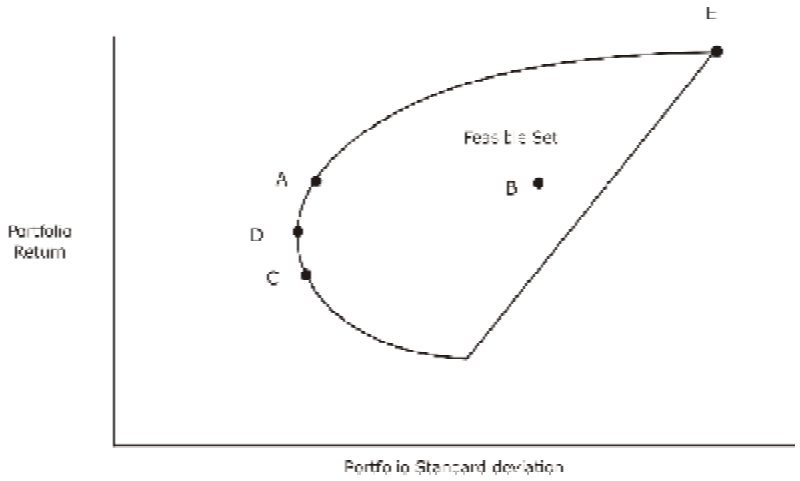
Figure 6.2 : Return and Risk of Some of the Nifty stocks



Source: NSE

All these stocks (in figure 6.2) have correlations between 0 and 1. Therefore, their combination could theoretically be characterized as given in figure 6.3.

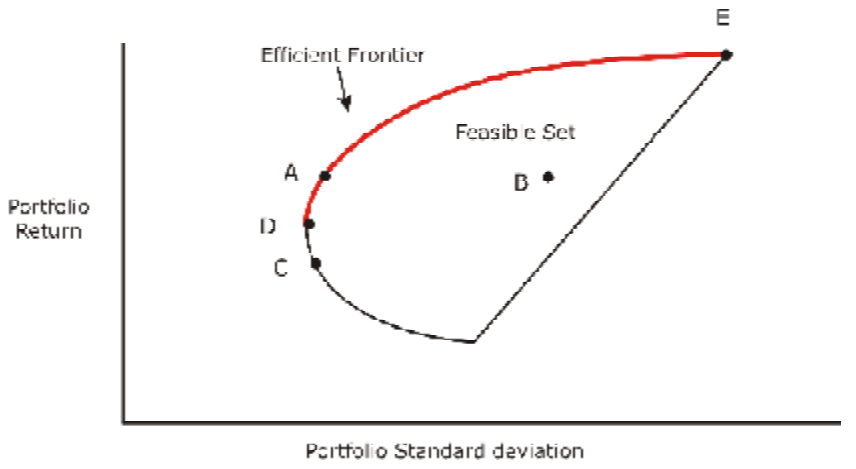
Figure 6.3 : Feasible Set of Portfolios



All the feasible portfolio combinations can be represented by the space enclosed by the curved line and the straight-line. The curved line represents combinations of stocks or portfolios where correlations are less than 1, whereas portfolios along the straight-line represent combinations of stocks or portfolios with the maximum correlation (+1.0) (no portfolios would lie to the right of the straight-line).

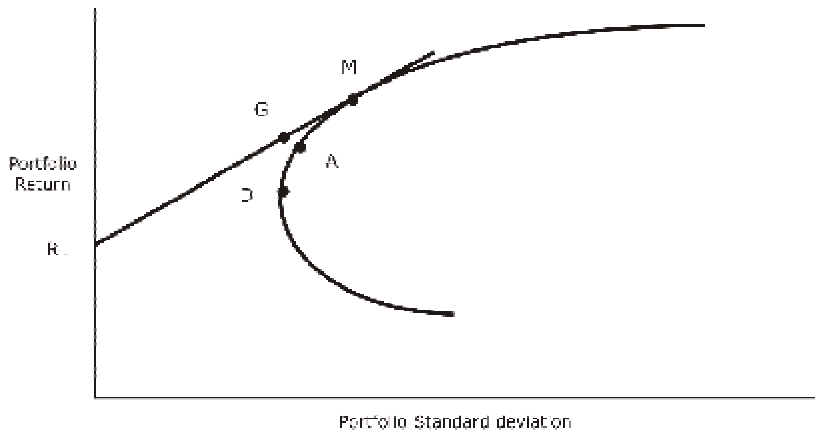
Obviously, a mean-variance investor would prefer portfolio A to B, given that it has lower risk for the same level of return offered by B. Similarly, portfolio A would be preferred to portfolio C, given that it offers higher return for the same level of risk. D is the minimum variance portfolio among the entire feasible set. A close examination of the feasible set of portfolios reveals that portfolios that lie along D-E represent the best available combination of portfolios. Investors with various risk tolerance levels can choose one of these portfolios. These portfolios offer the maximum return for any given level of risk. Therefore, these are called the *efficient portfolios* (and the set of all such portfolios, the *efficient frontier*), as represented in Figure 6.4.

Figure 6.4: Efficient Frontier



Ordinarily, the investor also has the opportunity to invest in a risk-free asset. Practically, this could be a bank deposit, treasury bills, Government securities or Government guaranteed bonds. With the availability of a risk-free security, the choice facing the mean-variance investor can be conveniently characterised as follows:

Figure 6.5 : Efficient Portfolio in the Presence of a Risk-Free Asset



As given in figure 6.5, with the presence of the risk-free asset, that has no correlation with any other risky asset, the investor also gets an added opportunity to combine portfolios along the efficient frontier with the risk-free asset. This would imply that the investor could partly put the money in the risky security and the remaining in any of the risky portfolios.

Apparently, the portfolio choice of the mean-variance investor is no more the securities along the efficient frontier (D-E). If an investor prefers less risk, then rather than choosing D by going down the efficient frontier, he can choose G, a combination of risky portfolio M and the risk-free asset. G gives a higher return for the level of risk of D. In fact, the same applies for

all the portfolios along the efficient frontier that lie between D and M (they offer only lower returns compared to those which lie along the straight-line connecting the risk-free asset and risky portfolio M).

This gives the powerful insight that, with the presence of the risk-free security, the most preferred portfolio along the efficient frontier would be M (portfolios to the right of M along the straight line indicates borrowing at the risk-free rate and investing in M).

An investor who does not want to take the risk of M, would be better off by combining with the risk-free security rather than investing in risky portfolios with lower standard deviation (that lie along the M-D).

Identification of M as the optimal portfolio, combined with the assumptions (1) that all investors have the same information about mean and variance of securities and (2) they all have the same investment horizon, suggest that all the investors would hold only the following portfolios depending on the risk appetite.

1. **The portfolio purely of risky assets, which would be M.**
2. **The portfolio of risky assets and risk-free asset, which would be a combination of M and R_F.**

All other portfolios are inferior to these choices, for any level of risk preferred by the investors. Let us examine what would be the nature of the portfolio M. If all investors are mean-variance optimizers and have the same information, their portfolios would invariably be the same. Then, all of them would identify the same portfolio as M. Obviously, it should be a combination of all the risky stocks (assets) available in the market (somebody should be willing to hold all the assets available on the market). This portfolio is referred to as the market portfolio. Practically, the market portfolio can be regarded as one represented by a very liquid index like the NIFTY. The line connecting the market portfolio to the risk-free asset is called the Capital Market Line (CML). All points along the CML have superior risk-return profiles to any portfolio on the efficient frontier.

With the understanding about the aggregate behaviour of the investors in the securities market, we can estimate the risk premium that is required for any asset. Understanding the risk premium dramatically solves the asset pricing problem through the estimation of the discounting factor to be applied to the expected cash flows from the asset. With the expected cash flows and the discounting rate, the price of any risky asset can be directly estimated.

Let R_M be the required rate of return on the market (market portfolio, M), R_F be the required rate of return on the risk free asset and σM be the standard deviation of the market portfolio. From Figure 6.5, the rate of risk premium required for unit variance of the market is estimated as,

$$\frac{R_M - R_F}{\sigma_M^2} \qquad (6)$$

In a very liquid market (where assets can be bought and sold without much hassles), investor has the opportunity to hold stocks as a portfolio rather than in isolation. If investors have the opportunity to hold a well-diversified portfolio, the only risk that matters in the individual security is the incremental risk that it contributes to a well-diversified portfolio. Therefore, the risk relevant to the prospective investor (or firm) is the covariance risk. Then, one can compute the risk premium required on the security as follows

$$\textit{Risk premium on stock} = \frac{R_M - R_F}{\sigma_M^2} \times Cov\ (i, M)$$

where, Cov*(i,M)*, is the covariance between the returns of stock i and the market returns (returns on portfolio M). The quantity represented by $\frac{Cov\ (i, M)}{\sigma_M^2}$ is popularly called the beta (β). This measures the sensitivity of the security compared to the market. A beta of 2.0 indicates that if the market moves down (up) by 1%, the security is expected to move down (up) 2%. Therefore, we would expect twice the risk premium as compared to the market. This implies that the minimum expected return on this stock is 2 x ($R_m - R_f$). In general, the risk premium on a security is β times ($R_m - R_f$). Obviously, the market portfolio will have a beta of 1.0 (covariance of a stock with itself is variance).

Now by combining the risk-free rate and the risk premium as estimated above, the total required rate of return on any risky asset is,

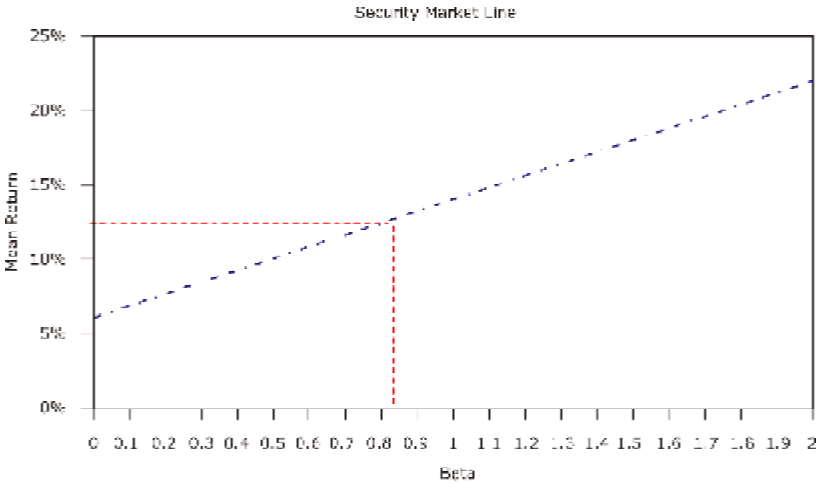
$$R_i = R_F + (R_M - R_F)\,\beta_i \qquad (7)$$

This approach to the estimation of the required return of assets (cost of equity, in case of equity) is called the Capital Asset Pricing Model (CAPM, pioneered by William Sharpe).

If CAPM holds in the market, all the stocks would be priced according to their beta. This would imply that the stock prices are estimated by the market by discounting the expected cash flows by applying a discounting rate as estimated based on equation (7).

Hence, all the stocks can be identified in the mean return-beta space, as shown below and relationship between beta and return can be estimated. The line presented in the following figure is popularly called the ***Securities Market Line (SML)*.**

Figure 6.6 : Security Market Line

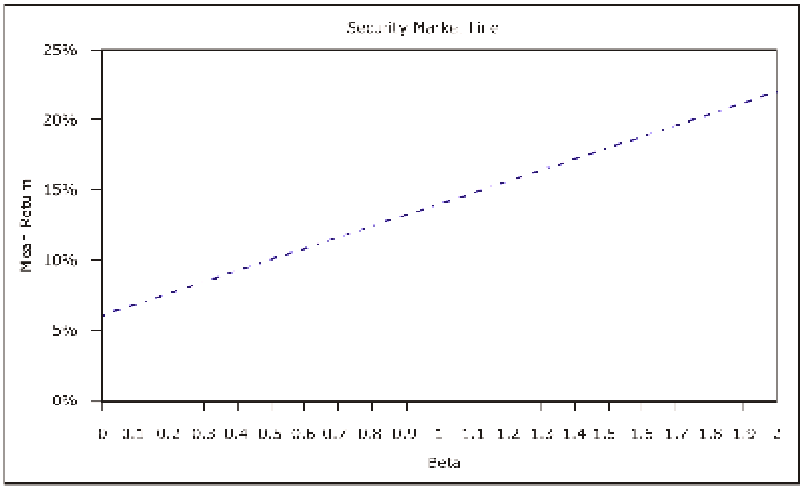


Note: this figure is not based on any real data.

Prices (returns) which are not according to CAPM shall be quickly identified by the market and brought back to the equilibrium. For instance, stocks A and B given in the following figure (6.7) shall be brought back to the equilibrium through market dynamics.

This works as follows. Stock A, currently requires a lower risk premium (required rate of return) than a specified by CAPM (the price is higher). Sensing this price of A as relatively expensive, the mean-variance investors would sell this stock. The decreased demand for the stock would push its price downwards and restore the return back to as specified by CAPM (will be on the line). The reverse happens in case of stock B, with increased buying pressure.

Figure 6.7 : Arbitrages around SML



6.3.2 *Estimation of Beta*

The beta of a stock can be estimated with the formula discussed above. Practically, the beta

of any stock can be conveniently estimated as a regression between the return on stock and that of the market, represented by a stock index like NIFTY (the dependent variable is the stock return and the independent variables is the market return).

Accordingly, the regression equation is,

$$R_i = \alpha_i + \beta_i R_M + e_i, \qquad (8)$$

where the regression coefficient β_i represents the slope of the linear relationship between the stock return and the market return and α_i denote the risk-free rate of return. The SLOPE function in MS-Excel is a convenient way to calculate this coefficient from the model.

The beta of an existing firm traded in the market can be derived directly from the market prices. However, on many occasions, we might be interested to estimate the required rate of return on an asset which is not traded in the market. For instances like, pricing of an IPO, takeover of another firm, valuation of certain specific assets etc.. In these instances, the required rate of return can be estimated by obtaining the beta estimates from similar firms in the same industry.

The beta can be related to the nature of the assets held by a firm. If the firm holds more risky assets the beta shall also be higher. Now, it is not difficult to see why investors like venture capitalists demand higher return for investing in start-up firms. A firm's beta is the weighted average of the beta of its assets (just as the beta of a portfolio is the weighted average of the beta of its constituent assets).

6.4 Multifactor Models: The Arbitrage Pricing Theory (APT)

The CAPM is founded on the following two assumptions (1) in the equilibrium every mean variance investor holds the same market portfolio and (2) the only risk the investor faces is the beta. Evidently, these are strong assumptions about the market structure and behaviour of investors. A more general framework about asset pricing should allow for relaxation of these strong and somewhat counterfactual assumptions. A number of alternative equilibrium asset pricing models, including the general arbitrage pricing theory (APT), attempt to relax these assumptions to provide a better understanding about asset pricing.

The arbitrage pricing theory assumes that the investor portfolio is exposed to a number of systematic risk factors. Arbitrage in the market ensures that portfolios with equal sensitivity to a fundamental risk factor are equally priced. It further assumes that the risk factors which are associated with any asset can be expressed as a linear combination of the fundamental risk factors and the factor sensitivities (betas). Arbitrage is then assumed to eliminate all opportunities to earn riskless profit by simultaneously selling and buying equivalent portfolios (in terms of risk) which are overpriced and underpriced.

Under these assumptions, all investors need not have the same market portfolio as under CAPM. Hence, APT relaxes the assumption that all investors in the market hold the same portfolio. Again, as compared to CAPM, which has only one risk dimension, under the APT characterization of the assets, there will be as many dimensions as there are fundamental risks, which cannot be diversified by the investors. The fundamental factors involved could for instance be the growth rate of the economy (GDP growth rate), inflation, interest rates and any other macroeconomic factor which would expose the investor's portfolio to systematic risk.

In the lines of the assumptions of arbitrage pricing theory, a number of multifactor asset pricing models have been proposed. One such empirically successful model is the so-called *Fama-French three-factor model*. The Fama-French model has two more risk factors, viz., size, and book-to-market ratio as the additional risk factors along with the market risk as specified by CAPM. The size risk factor is the difference between the expected returns on a portfolio of small stocks and that of large stocks. And the book-to-market ratio is the difference in the expected return of the portfolio of high book-to market-ratio stocks and that of low book-to market-ratio stocks.

Theoretical and empirical evidence suggests that in the real market, expected returns are probably determined by a multifactor model. Against this evidence, the most popular and simple equilibrium model, CAPM, could be regarded as a special case where all investors hold the same portfolio and their only risk exposure is the market risk.

CHAPTER 7: Valuation of Derivatives

7.1 Introduction

Derivatives are a wide group of financial securities defined on the basis of other financial securities, i.e., the price of a derivative is dependent on the price of another security, called the underlying. These underlying securities are usually shares or bonds, although they can be various other financial products, even other derivatives. As a quick example, let's consider the derivative called a 'call option', defined on a common share. The buyer of such a product gets the right to buy the common share by a future date. But she might not want to do so—there's no obligation to buy it, just the choice, the option. Let's now flesh out some of the details. The price at which she can buy the underlying is called the strike price, and the date after which this option expires is called the *strike date*. In other words, the buyer of a call option has the right, but not the obligation to take a long position in the underlying at the strike price on or before the strike date. Call options are further classified as being European, if this right can only be exercised on the strike date and American, if it can be exercised any time up and until the strike date.

Derivatives are amongst the widely traded financial securities in the world. Turnover in the futures and options markets are usually many times the cash (underlying) markets. Our treatment of derivatives in this module is somewhat limited: we provide a short introduction about of the major types of derivatives traded in the markets and their pricing.

7.2 Forwards and Futures

Forward contracts are agreements to exchange an underlying security at an agreed rate on a specified future date (called expiry date). The agreed rate is called forward rate and the difference between the spot rate, the rate prevailing today, and the forward rate is called the forward margin. The party that agrees to buy the asset on a future date is referred to as a long investor and is said to have a long position. Similarly, the party that agrees to sell the asset in a future date is referred to as a short investor and is said to have a short position.

Forward contracts are bilateral (privately negotiated between two parties), traded outside a regulated stock exchange (traded in the OTC or 'Over the Counter' market) and suffer from counter-party risks and liquidity risks. Here counter-party risk refers to the default risk that arises when one party in the contract defaults on fulfilling its obligations thereby causing loss to the other party.

Futures contracts are also agreements to buy or sell an asset for a certain price at a future time. Unlike forward contracts, which are traded in the over-the-counter market with no standard contract size or delivery arrangements, futures contracts are standardized contracts and are

traded on recognized and regulated stock exchanges. They are standardized in terms of contract sizes, trading parameters and settlement procedures, and the contract or lot size (no. of shares/units per contract) is fixed.

Since futures contracts are traded through exchanges, the settlement of the contract is guaranteed by the exchange or a clearing corporation (through the process of novation) and hence there is no counter-party risk. Exchanges guarantee execution by holding a caution amount as security from both the parties (buyers and sellers). This amount is called as the margin money, and is adjusted daily based on price movements of the underlying till the contract expires.

Compared to forward contracts, futures also provide the flexibility of closing out the contract prior to the maturity by squaring off the transaction in the market. Occasionally the fact forward contracts are bilateral comes in handy—two parties could suit a contract according to their needs; such a futures may not be traded in the market. Primary examples are long-term contracts—most futures contracts have short maturities of less than a few months.

The table here draws a comparison between a forward and a futures contract.

Table 7.1 : Comparison of Forward and Futures Contracts

	Forward Contract	Futures Contract
Nature of Contract	Non-standardized/ Customized contract	Standardized contract
Trading	Private contract between parties – Informal, Over-the-Counter market	Traded on an exchange
Settlement	Set by the parties. Pre-specified in the contract.	Final Settlement date is fixed by the exchange. In addition, there is a provision of daily settlement, known as daily mark to market settlement.
Risk	Counterparty risk exists, no independent guarantee.	Exchange provides the guarantee of settlement and hence no counter party risk.

7.3 Call and Put Options

Like forwards and futures, options are derivative instruments that provide the opportunity to buy or sell an underlying asset on a future date. As explained in the introduction, an option contract is a contract written by a seller that conveys the buyers a right, but not an obligation to either sell (put option) or buy (call option) a particular asset at a specified price in the future. In case of call options, the option buyer has a right to buy and in case of put options, the option buyer has a right to sell the security at the agreed upon price (called strike rate or exercise price). In return for granting the option, the party (seller) granting the option collects a payment from the other party. This payment collected is called the "premium" or price of the option.

Options are like insurance contracts. Unlike futures, where the parties are denied of any favorable movement in the market, in case of options, the buyers are protected from downside risks and in the same time, are able to reap the benefits from any favorable movement in the exchange rate. The buyer of the option has a right but no obligation to enforce the execution of the option contract and hence, the maximum loss that the option buyer can suffer is limited to the premium amount paid to enter into the contract. The buyer would exercise the option only when she can make some profit from the exercise, otherwise, the option would not be exercised, and be allowed to lapse. Recall that in case of American options, the right can be exercised on any day on or before the expiry date but in case of a European option, the right can be exercised only on the expiry date.

Options can be used for hedging as well as for speculation purposes. An option is used as a hedging tool if the investor already has (or is expected to have) an open position in the spot market. For example, in case of currency options, importers buy call options to hedge against future depreciation of the local currency (which would make their imports more expensive) and exporters could buy put options to hedge against currency appreciation. There are other methds of hedging too—using forwards, futures, or combinations of all three—and the choice of hedging is determined by the costs involved.

7.4 Forward and Futures Pricing

Forwards/ futures contract are priced using the cost of carry model. The cost of carry model calculates the fair value of futures contract based on the current spot price of the underlying asset. The formula used for pricing futures is given below:

$F = Se^{rT}$ ***Where*** **:**

F = Futures Price

S = Spot price of the underlying asset

R = Cost of financing (using a continuously compounded interest rate)

T = Time till expiration in years

E = 2.71828 (The base of natural logarithms)

Example: Security of ABB Ltd trades in the spot market at Rs. 850. Money can be invested at 11% per annum. The fair value of a one-month futures contract on ABB is calculated as follows:

$$F = Se^{rT} = 850 * e^{0.11\frac{1}{12}} = 857.80$$

The presence of arbitrageurs would force the price to equal the fair value of the asset. If the futures price is less than the fair value, one can profit by holding a long position in the futures and a short position in the underlying. Alternatively, if the futures price is more than the fair value, there is a scope to make a profit by holding a short position in the futures and a long position in the underlying. The increase in demand/ supply of the futures (and spot) contracts will force the futures price to equal the fair value of the asset.

7.4.1 *Cost-of-carry and convenience yield*

The cost of carry is the cost of holding a position. It is usually represented as a percentage of the spot price. Generally, for most investment, we consider the risk-free interest rate as the cost of carry. In case of commodities contracts, cost of carry also includes storage costs (also expressed as a percentage of the spot price) of the underlying asset until maturity.

Futures prices being lower than spot price (backwardation) is also explained by the concept of convenience yield. It is the opposite of carrying charges and refers to the benefit accruing to the holder of the asset. For example, one of the benefits to the inventory holder is the timely availability of the underlying asset during a period when the underlying asset is otherwise facing a stringent supply situation in the market. Convenience yield has a negative relationship with inventory storage levels (and storage cost). High storage cost/high inventory levels lead to negative convenience yield and vice versa.

The cost of carry model expresses the forward (future) price as a function of the spot price and the cost of carry and convenience yield.

$$F = [S + PV\ (storage\ cost)] * e^{(r-c)t}$$

Where F is the forward price, S is the spot price, r is the risk-free interest rate, c is the convenience yield and t is the time to delivery of the forward contract (expressed as a fraction of 1 year).

7.4.2 *Backwardation and Contango*

The theory of normal backwardation was first developed by J. M. Keynes in 1930. The theory suggests that the futures price is a biased estimate of the expected spot price at the maturity. The underlying principle for the theory is that hedgers use the future market to avoid risks and pay a significant amount to the speculators for this insurance. When the future price is lower than the current spot price, the market is said to be *backwarded* and the opposite is called as a *contango market*. Since future and spot prices have to converge on maturity (this is sometimes called the law of one price), in the case of a backwarded market, the future price will increase relative to the expected spot price with passage of time, the process referred to as backwardation. In case of contango, the future price decreases relative to the expected spot price.

Backwardation and contango is easily explained in terms of the seasonal nature of commodities. Commodity futures with expiration dates falling in post harvest month would face backwardation, as the expected spot price would be lower. When hedgers are net short (farmers willing to sell the produce immediately after harvest), or the risk aversion is more for short hedgers than the long hedgers, the futures price would be a downward biased estimate of the expected spot price, resulting into a backwarded market.

7.5 Option Pricing

Our brief treatment of options in this module initially looks at pay-off diagrams, which chart the price of the option with changes in the price of the underlying and then describes how call and option prices are related using put-call parity. We then briefly describe the celebrated Black-Scholes formula to price a European option.

7.5.1 *Payoffs from option contracts*

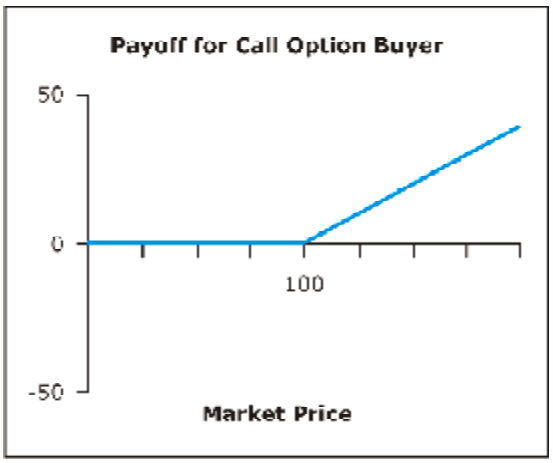
Payoffs from an option contract refer to the value of the option contract for the parties (buyer and seller) on the date the option is exercised. For the sake of simplicity, we do not consider the initial premium amount while calculating the option payoffs.

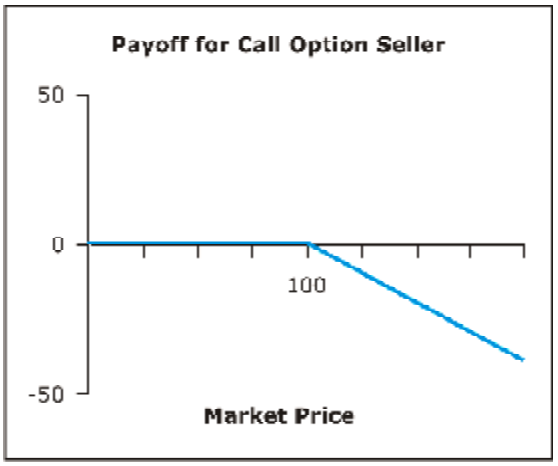
In case of call options, the option buyer would exercise the option only if the market price on the date of exercise is more than the strike price of the option contract. Otherwise, the option is worthless since it will expire without being exercised. Similarly, a put option buyer would exercise her right if the market price is lower than the exercise price.

The payoff of a call option buyer at expiration is:

***Max* [(*Market price of the share – Exercise Price*), 0]**

The following figures shows the payoff diagram for call options buyer and seller (assumed exercise price is 100)

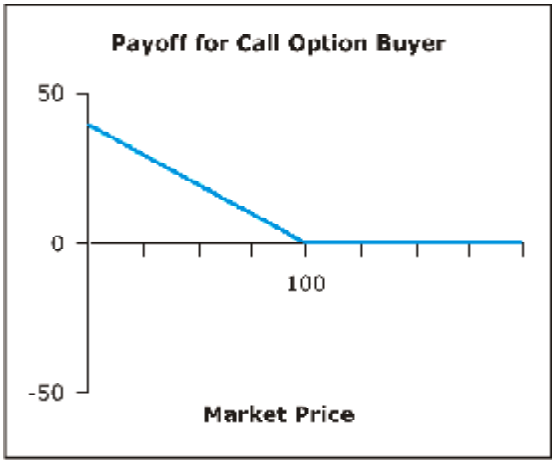


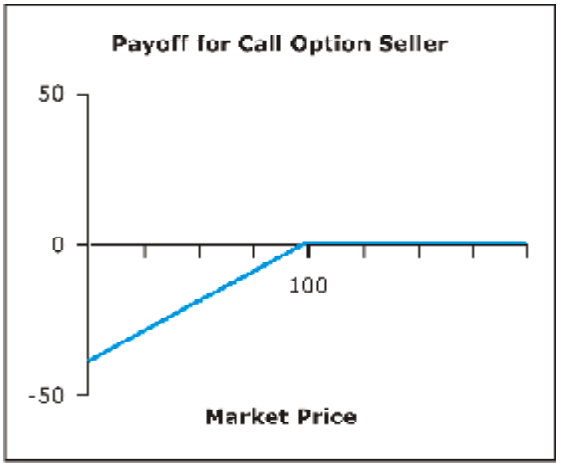


The payoff for a buyer of a put option at expiration is:

***Max* [(*Exercise price – Market price of the share*), 0]**

The payoff diagram for put options buyer and seller (assumed exercise price is 100)





From the pay-off diagrams it's apparent that a buyer of call options would expect the market price of the stock to rise, and buying the call option allows him to lock in the benefits of such a rise, and also cap the downside in the event of a fall. The price of course is the premium. On the other side, a seller of call options has a contrarian view, and hopes to profit from the premium of the call options sold that would expire unexercised. It's clear from the vertical axis of the payoff diagram (which provides the payoff the contract), that while the downside of a call option buyer is limited, it is not so for the seller.

In a similar sense, a buyer of put options would expect the market to fall, and profit from it, with an insurance, or a hedge (in the event of an unexpected rise in the market), to cap the downside. The price of the hedge is the put option premium.

7.5.2 *Put-call parity relationship*

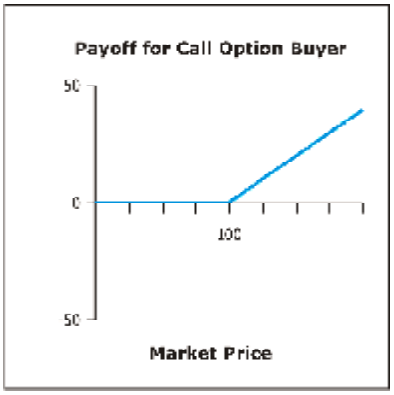
The put-call parity relationship gives us a fundamental relationship between European call options and put options. The relationship is derived by noticing that the payoff from the following two strategies is the same irrespective of the stock price at maturity. The two strategies are:

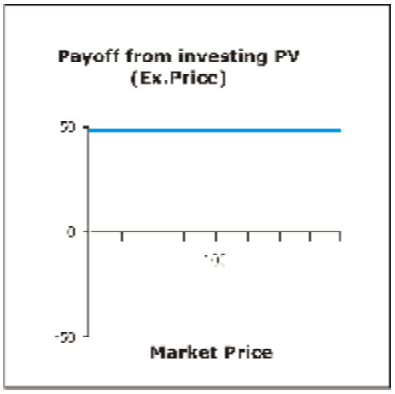
Strategy 1: Buy a call option and investing the present value of exercise price in risk-free asset.

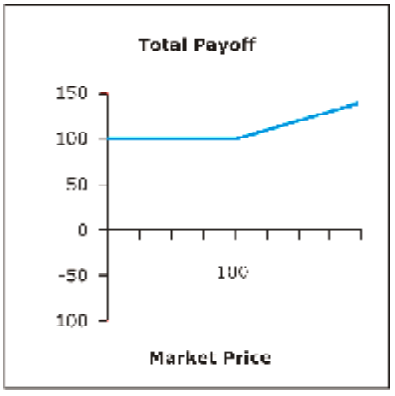
Strategy 2: Buy a put option and buying a share.

This can be shown in the form of the following diagram:

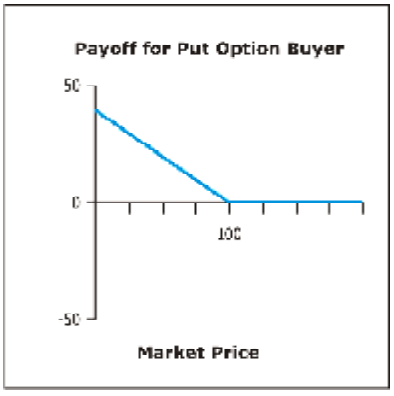
Strategy 1:

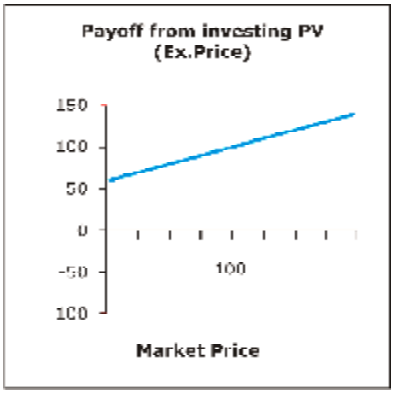






Strategy 2:





Since the payoff from the two strategies is the same therefore:

Value of call option (C) + PV of exercise price $\left(Ke^{-rt}\right)$ = value of put option (P) + Current share price (S_0), i.e.

$$C + Ke^{-rt} = P + S_0$$

7.6 Black-Scholes formula

The main question that is still unanswered is the price of a call option for entering into the option contract, i.e. the option premium. The premium amount is dependent on many variables. They are:

- **Share Price** (S_0)
- **Exercise Price (K)**
- **The time to expiration i.e. period for which the option is valid (T)**
- **Prevailing risk-free interest rate (r)**
- **The expected volatility of the underlying asset (** σ **)**

One of the landmark inventions in the financial world has been the Black-Scholes formula to price a European option. Fischer Black and Myron Scholes2 in their seminal paper in 1973 gave the world a mathematical model to value the call options and put options. The formula proved to be very useful not only to the academics but also to practitioners in the finance world. The authors were later awarded The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel in 1997. The Black-Scholes formula for valuing call options (c) and value of put options (p) is as under:

$$c(S,t) = SN(d_1) - ke^{-r(T-t)} N(d_2) \text{ and}$$

$$p(S,t) = Ke^{-r(T-t)} N(-d_2) - SN(-d_1)$$

Where

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\sqrt{T-t}$$

Where,

$N(.)$ **is the cumulative distribution function (cdf) of the standard normal distribution**

T-t is the time to maturity

S is the spot price of the underlying asset

K is the strike price

r is the continuously compounded annual risk-free rate

σ **is the volatility in the log returns of the underlying.**

Example: Calculate the value of a call option and put option for the following contract:

Stock Price (S) = 100

Exercise Price (K) = 105

Risk-free, continuously compounded interest Rate (r) = 0.10 (10%)

Time to expiration (T-t) = 3 month = 0.25 years

Standard deviation (σ) = 0.30 per year

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}} = \frac{\ln\left(\frac{100}{105}\right) + \left(0.10 + \frac{0.3^2}{2}\right)(0.25)}{0.3 * 0.25} = -0.0836$$

$$d_2 = d_1 - \sigma\sqrt{T-t} = 0.0836 - 0.3\sqrt{0.25} = -.0236$$

$$N(d_1) = N(-0.0836) = 0.4667$$

$$N(d_2) = N(-0.0236) = 0.4076$$

$$N(-d_1) = N(0.0836) = 0.5333$$

$$N(-d_2) = N(0.0236) = 0.5924$$

Value of call option (c) =

$$c(S,t) = SN(d_1) - ke^{-r(T-t)} N(d_2) = 100 * 0.4667 - 105 * e^{-.10*0.25} * 0.4076 = 4.9225$$

Value of Put option (p) =

$$p(S,t) = Ke^{-r(T-t)} N(-d_2) - SN(-d_1) = 105 * e^{-0.10*0.25} * 0.5924 - 100 * 0.5333 = 7.33$$

[2] *Black, Fischer; Myron Scholes (1973). "The Pricing of Options and Corporate Liabilities". Journal of Political Economy 81 (3): 637-654*

CHAPTER 8: Investment Management

8.1 Introduction

In the final chapter of this module we take a brief look at the professional asset management industry. Worldwide, the last few decades have seen an increasing trend away from direct investment in the markets, with the retail investor now preferring to invest in funds or the index, rather than direct exposure into equities. This has naturally led to a sharp increase in the assets under management of such firms.

The asset management industry primarily consists of two kinds of companies, those engaged in investment advisory or *wealth management* activities, and those into investment management. In the first category, investment advisory firms recommend their clients to take positions in various securities, and wealth management firm either recommend, or have custody of their clients' funds, to be invested according to their discretion. In both cases, the engagement with clients is at an account level, i.e., funds are separately managed for each client. In contrast, investment management companies combine their clients' assets towards taking positions in a single portfolio, usually called a *fund (or a mutual fund)*. A unit of such a fund then represents positions in each of the securities owned in the portfolio. Instead of tracking returns on their own portfolios, clients track returns on the net asset value (NAV) of the fund. In addition to the perceived benefits of professional fund management, the major reason of investment into funds is the diversification they afford the investor. For instance, instead of owning every large-cap stock in the market, an investor could just buy units of a large-cap fund.

In this chapter, we shall examine the various types of such funds, differentiated by their investment mandates, choice of securities, and of course, investment performance, where we would outline a few of the key metrics used to measure investment performance of funds.

8.2 Investment Companies

Investment companies pool funds from various investors and invest the accumulated funds in various financial instruments or other assets. The profits and losses from the investment (after repaying the management expenses) are distributed to the investors in the funds in proportion to the investment amount. Each investment company is run by an asset management company who simultaneously operate various funds within the investment company. Each fund is managed by a fund manager who is responsible for management of the portfolio.

Investment companies are referred to by different names in different countries, such as mutual funds, investment funds, managed funds or simply funds. In India, they are called mutual funds. Our treatment would use these names interchangeably, unless explicitly stated.

8.2.1 *Benefits of investments in managed funds*

The main advantages of investing through collective investment schemes are:

- ***Choice of Schemes:*** **There are various schemes with different investment themes. Through each scheme an investor has an opportunity to invest in a wide range of investable securities.**
- ***Professional Management:*** **Professionally managed by team of experts.**
- ***Diversification:*** **Scope for better diversification of investment since mutual fund assets are invested across a wide range of securities.**
- ***Liquidity:*** **Easy entry and exit of investment: investors can with ease buy units from mutual funds or redeem their units at the net asset value either directly with the mutual fund or through an advisor / stock broker.**
- ***Transparency:*** **The asset management team has to on a regular basis publish the NAV of the assets and broad break-up of the instruments where the investment is made.**
- ***Tax benefits:*** **Dividends received on investments held in certain schemes, such as equity based mutual funds, are not subject to tax.**

8.3 Active vs. Passive Portfolio Management

If asset prices always reflect their equilibrium values (expected returns equal to the value specified by an asset pricing model), then an investor is unlikely to benefit from actively searching for mispriced (overpriced/underpriced) opportunities in assets. In other words, the investor is better off by simply investing in the market, or a representative benchmark. For instance, under such assumptions, an Indian equity investor would achieve the best possible outcome by trying to replicate the Nifty 50 by investing in the constituent stocks in the same proportion as they are in the index.

Such investment assumes that gains in the market are those of the benchmark, and not in the choice of individual securities, as opportunities in their selection, or timing of entry/exit are too short to be taken advantage of. This, passive approach to investment rests upon the theory of market efficiency, which we saw in chapter 4. Recall that the EMH postulates that prices always fully reflect all the available information and any deviation from the full information price would be quickly arbitraged away. In an efficient market, information about fundamental factors related to the asset, or its market price, volume or any other related trading data related has little value for the investor.

Passive fund managers try to replicate the performance of a benchmark index, by replicating the weights of its constituent stocks. Given daily price movement in stock prices, the challenge for such managers is to minimize the so-called 'tracking error' of the fund, which is calculated as the deviation in its returns from that of the index. The choice of the index further differentiates between the funds, for example, an equity index fund would simply try to maintain the return profile of the benchmark index, say, the NIFTY 50; but if investments are allowed across asset classes, then the 'benchmark' could well consist of a combination of a equity and a debt index.

Recent evidence of systematic departures of asset prices in the from equilibrium values, as envisaged under the market efficiency, has renewed interest in 'active' fund management, which entails that optimal selection of stocks, and the timing of entry/exit could lead to 'market-beating' returns.

This represents an opportunity for investors to engage in active strategies based on their objective views about the assets. In a generic sense, such views are about the relative under pricing or over pricing of an asset. Over pricing presents an opportunity to engage in short selling, under pricing an opportunity to take a long position, and combinations of the two are also possible, across stocks, and portfolios.

The objective of an active portfolio manager is to make higher profits from investing, with similar, or lower risks attached. The risk of a portfolio, as noted in an earlier chapter, is usually measured with the standard deviation of its assets. A good portfolio manager should have good forecasting ability and should be able to do two things better than his competitors: market timing and security selection.

By market timing, we refer to the ability of the portfolio manager to gauge at the beginning of each period the profitability of the market portfolio vis-à-vis the risk-free portfolio of Government bonds. The strength of such a signal would indicate the level of investment required in the market.

By security selection, we refer to ability of a portfolio manager in identifying mispricing in individual securities and then investing in securities with the maximum mispricing, which maximizes the so-called alpha. The alpha of a security refers to the expected excess return of the security over the expected rate of return (for example, estimated by an equilibrium asset-pricing model like the CAPM). The mispricing may be either way: If the portfolio manager believes that a security is going to generate negative return, his portfolio should give a negative weight for the same i.e. short the security and vice versa. The tradeoff for the active investor is the presence of nonsystematic risk in the portfolio. Since the portfolio of an active investor is not fully diversified, there is some nonsystematic (firm-specific) risk that is not diversified away. Active fund management is a diverse business—there are many ways to make money in

the market—almost all the investment styles we would examine further in the chapter are illustrative examples.

Active and passive fund management are not always chalk and cheese—there are techniques that utilize both, like portfolio tilting. A tilted portfolio shifts the weights of its constituents towards one or more of certain pre-specified market factors, like earnings, valuations, dividend yields, or towards one or more specific sectors.

By their very nature of operations, active and passive investments differ meaningfully in terms of their costs to the investors. Passive investment is characterized by low transaction costs (given their low turnover), management expenses, and the risks attached. Active fund management is understandably more expensive, but has seen costs falling over the years on competitive pricing and increased liquidity of the markets, which reduced transaction costs.

8.4 Costs of Management: Entry / Exit Loads and Fees

Running a mutual fund involves certain costs (e.g. remuneration to the management team, advertising expenses etc.) which may be recurring or non-recurring in nature. These costs are recovered by the fund from the investors (e.g. from redemption fees) or from charges on the assets (transaction fees, management fees and commission etc.) of the funds.

Generally, the management team is paid a fixed percentage of the asset under management as their fees.

Investment management companies can be broadly classified on the basis of the securities they invest in and their investment objectives. Before we look at either, we define the core measure of return for a fund, the *NAV*, and so-called *open*, and *closed-ended funds*.

8.5 Net Asset Value

The net asset value NAV is the most important and widely followed metric of a fund's performance. It is calculated per share using the following formula:

$$NAV\ (per\ share) = \frac{Market\ Value\ of\ Assets - Market\ Value\ of\ liabilities}{Number\ of\ shares\ outstandign}$$

Net asset value (NAV) is a term used to describe the per unit value of the fund's net assets (assets less the value of its liabilities). Hence the NAV for a fund is

Fund NAV = (Market Value of the fund portfolio – Fund Expenses) / Fund Shares Outstanding

Just like the share price of a common stock, the NAV of a fund would rise with the value of the fund portfolio, and is instantly reflective of the value of investment.

8.6 Classification of funds

8.6.1 *Open ended and closed-ended funds*

Funds are usually open or closed-ended. In an open-ended fund, the units are issued and redeemed by the fund, at any time, at the NAV prevalent at the time of issue / redemption. The fund discloses the NAV on a daily basis to facilitate issue and redemption of units. Unlike open-ended funds, closed-ended funds sell units only at the outset and do not redeem or sell units once they are issued. The investors can sell or purchase units to (or from) other investors and to facilitate such transactions, such units are traded on stock exchanges. Price of closed ended schemes are determined based on demand and supply for the units at the stock exchange and can be more or less than the NAV of the units.

We now examine the different kind of funds on the basis of their investments. While we had earlier mentioned mutual fund investments represented as units in a single portfolio, in real life, fund houses float various schemes from time-to-time, each a constituting a portfolio where inputs translate into units. These schemes are differentiated by their charter which mandates their investment into asset classes.

Beyond the type of instruments they invest in, fund houses are also differentiated in terms of their investment styles. The approaches to equity investing could be diversified or undiversified, growth, income, sector rotators, value, or market-timing based.

Each mutual fund scheme has a particular investment policy and the fund manager has to ensure that the investment policy is not breached. The policy is laid right at the outset when the fund is launched and is specified in the prospectus, the *'Offer Document'* of the scheme. The investment policy determines the instruments in which the money from a specific scheme will be primarily invested. Based on these securities, mutual funds can be broadly classified into equity funds (growth funds and income funds), bond funds, money market funds, index funds, etc. Generally, fund houses have dozens of schemes floating in the market at any given time, with separate investment policies for each scheme.

8.6.2 *Equity funds*

Equity funds primarily invest in common stock of companies. Equity funds can be growth funds or income funds. Growth funds focus on growth stocks, i.e., companies with strong growth potential, with capital appreciation being the major driver, while income funds focus on companies that have high dividend yields. Income funds focus on dividend income or coupon payments from bonds (if they are not pure equity).

Equity funds may also be sector-specific wherein the investment is restricted to stocks from a specific industry. For example, in India we have many funds focusing on companies in power sector and infrastructure sector.

8.6.3 *Bond funds*

Bond funds invest primarily in various bonds that were described in the earlier segment. They have a stable income stream and relatively lower risk. They could potentially invest in corporate bonds, Government. bonds, or both.

8.6.4 *Index funds*

Index funds have a passive investment strategy and they try to replicate a broad market index. A scheme from such a fund invests in components of a particular index proportionate to their representation in the benchmark. It is possible that a scheme tracks more than one index (in some pre-specified ratio), in either equity, or across asset classes.

8.6.5 *Money market funds*

Money market mutual funds invest in money market instruments, which are short-term securities issued by banks, non-bank corporations and Governments. The various money market instruments have already been discussed earlier.

8.6.6 *Fund of funds*

Fund of funds add another layer of diversification between the investor and securities in the market. Instead of individual stocks, or bonds, these mutual funds invest in units of other mutual funds, with the fund managers' mandate being the optimal choice across mutual fund schemes given extant market conditions.

8.7 Other Investment Companies

In addition to the broad categories mentioned here, there are many other kinds of funds, depending on market opportunities, and investor appetite. Total return funds look at a combination of capital appreciation and dividend income. Hybrid funds invest in a combination of equity, bonds, convertibles, and derivative instruments. These funds could be further distributed as 'asset allocation', 'balanced', or 'flexible portfolio' funds, based on the breadth of their investment in different asset classes, and the frequency of modifying the allocation.

Global, regional, or emerging market funds recognize investment opportunities across the world, and accordingly base their investment focus. Such funds could again comprise either, or a combination of equity, debt, or hybrid instruments. We mention some other, specific types of investment vehicles below.

8.7.1 *Unit Investment Trusts (UIT)*

Similar to mutual funds, UITs also pool money from investors and have a fixed portfolio of assets, which are not changed during the life of the fund. Although the portfolio composition is actively decided by the sponsor of the fund, once established the portfolio composition is not changed (hence called unmanaged funds).

The way an UIT is established is different from that of other mutual funds. UITs are usually created by sponsors, who first make investment in the portfolio of securities. The entire portfolio is then transferred to a trust and the trustees issue trust certificates to the public, which is similar to shares. The trustees distribute the incomes from the investment and the maturity (capital) amount to the shareholders on maturity of the scheme.

8.7.2 *REITS (Real Estate Investment Trusts)*

REITS are also similar to mutual funds, but they invest primarily in real estates or loans secured by real estate. REIT can be of three types – equity, mortgage or hybrid trusts. Equity trusts invest in real estate assets, mortgage trusts invest in loans backed by mortgage and hybrid trusts invest in either.

8.7.3 *Hedge Funds*

Hedge funds are generally created by a limited number of wealthy investors who agree to pool their funds and hire experienced professionals (fund managers) to manage their portfolio. Hedge funds are private agreements and generally have little or no regulations governing them. This gives a lot of freedom to the fund managers. For example, hedge funds can go short (borrow) funds and can invest in derivatives instruments which mutual funds cannot do.

Hedge funds generally have higher management fees than mutual funds as well as performance based fees. The management fee (paid to the fund managers), in the case of hedge funds is dependent on the assets under management (generally 2 - 4%) and the fund performance (generally 20% of the excess returns over the market return generated by the fund).

8.8 Performance assessment of managed funds

Prior to the development of the modern portfolio theory (MPT), portfolio managers were evaluated by comparing the return generated by them with some broad yardstick. The risk borne by the portfolio managers or the source of performance such as market timing, market volatility, the security selections and valuations were not considered. With the development of the MPT, the goal of performance evaluation is to study whether the portfolio has provided superior returns compared to the risks involved in the portfolio or compared to an equivalent passive benchmark.

The performance evaluation approach tries to attribute the performance to the following:

- **Risk**
- **Timing: market or volatility**
- **Security selection – of industry or individual stocks**

Therefore:

a) **The focus of evaluation should be on excess returns**

b) **The portfolio performance must account for the difference in the risk**

c) **It should be able to distinguish the timing skills from the security selection skills.**

The assessment of managed funds involves comparison with a benchmark. The benchmark could be based on the Capital Market Line (CML) or the Security Market Line (SML). When it is based on capital Market Line, the relevant measure of the portfolio risk is σ and when based on Security Market Line, the relevant measure is β. Various measures are devised to evaluate portfolio performance, viz. Sharpe Ratio, Treynor Ratio and Jensen Alpha.

8.8.1 *Sharpe Ratio*

Sharpe ratio or 'excess return to variability' measures the portfolio excess return over the sample period by the standard deviation of returns over that period. This ratio measures the effectiveness of a manager in diversifying the total risk (σ). This measure is appropriate if one is evaluating the total portfolio of an investor or a fund, in which case the Sharpe ratio of the portfolio can be compared with that of the market. The formula for measuring the Sharpe ratio is:

$$\textit{Sharpe Ratio} = (\bar{r}_p - \bar{r}_f) \; / \; \sigma_p$$

This will be compared to the Shape ratio of the market portfolio. A higher ratio is preferable since it implies that the fund manager is able to generate more return per unit of total risks. However, managers who are operating specific portfolios like a value tilted or a style tilted portfolio generally takes a higher risks, and therefore may not be willing to be evaluated based on this measure.

8.8.2 *Treynor Ratio*

Treynor's measure evaluates the excess return per unit of systematic risks (β) and not total risks. If a portfolio is fully diversified, then β becomes the relevant measure of risk and the performance of a fund manager may be evaluated against the expected return based on the SML (which uses β to calculate the expected return). The formula for measuring the Treynor Ratio is:

$$\textit{Theynor Ratio} = (\bar{r}_p - \bar{r}_f) \; / \; \beta_p$$

8.8.3 *Jensen measure or (Portfolio Alpha)*

The Jensen measure, also called Jensen Alpha, or portfolio alpha measures the average return on the portfolio over and above that predicted by the CAPM, given the portfolio's beta and the average market returns. It is measured using the following formula:

$\alpha_p = \bar{r}_p - [\bar{r}_f + \beta_p (\bar{r}_M - \bar{r}_f)]$

The returns predicted from the CAPM model is taken as the benchmark returns and is indicated by the formula within the brackets. The excess return is attributed to the ability of the managers for market timing or stock picking or both. This measure investigates the performance of funds and especially the ability of the managers in stock selection in terms of these contributing aspects.

This measure is widely used in evaluating mutual fund performance. If α_P is positive and significant, it implies that the fund managers are able to identify stocks with high potential for excess returns. Market timing would refer to the adjustment in the beta of the portfolio in tandem with market movements. Specifically, timing skills call for increasing the beta when the market is rising and reducing the beta, when the market declines, for example through futures position. If the fund manager has poor market timing ability, then the beta of the portfolio would not have been significantly different during a market decline compared to that during a market increase.

Example: The data relating to market portfolio and an investor 'P' portfolio is as under:

	Investor P's Portfolio	Market Portfolio (M)
Average Return	28%	18%
Beta (β)	1.4	1
Standard Deviation (σ)	30%	20%

Assuming that the risk-free rate for the market is 8%, calculate (a) Sharpe Ratio (b) Treynor Ratio and (c) Jensen Alpha for the investor P and the market.

Answer:

	Investor P Portfolio	Market Portfolio (M)
Sharpe Ratio $= (\bar{r}_p - \bar{r}_f) / \sigma_p$	(28% - 8%)/30% = 0.67	(18% - 8%)/20% = 0.5
Treynor Ratio $= (\bar{r}_p - \bar{r}_f) / \beta_p$	(28% - 8%)/1.4 = 5	(18% - 8%)/1 = 10
Jensen Alpha $(\alpha_p) = \bar{r}_p - [\bar{r}_f + \beta_p (\bar{r}_M - \bar{r}_f)]$	28% - [8% + 1.4*(18% - 8%)] = 28% - 22% = 6%	18% - [8% + 1 (18% - 8%)] = 0

***

MODEL TEST

INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT MODULE

Q:1. **_____ would mean that no investor would be able to outperform the market with trading strategies based on publicly available information.** **[1 Mark]**

(a) **Semi strong form efficiency**

(b) **Weak-form efficiency**

(c) **Strong form efficiency**

Q:2. **A company's _____ provide the most accurate information to its management and shareholders about its operations.** **[1 Mark]**

(a) **advertisements**

(b) **financial statements**

(c) **products**

(d) **vision statement**

Q:3. **_____ fund managers try to replicate the performance of a benchmark index, by replicating the weights of its constituent stocks.** **[2 Marks]**

(a) **Active**

(b) **Passive**

Q:4. **Unlike term insurance, _____ ensure a return of capital to the policyholder on maturity, along with the death benefits.** **[1 Mark]**

(a) **high premium or low premium policies**

(b) **fixed or variable policies**

(c) **assurance or endowment policies**

(d) **growth or value policies**

Q:5. **Gross Profit Margin = Gross Profit / Net Sales** **[2 Marks]**

(a) **FALSE**

(b) **TRUE**

Q:6. **Security of ABC Ltd. trades in the spot market at Rs. 595. Money can be invested at 10% per annum. The fair value of a one-month futures contract on ABC Ltd. is (using continuously compounded method):** **[2 Marks]**

(a) **630.05**

(b) **620.05**

(c) **600.05**

(d) **610.05**

Q:7. Accounts payable appears in the Balance Sheet of companies. [2 Marks]

(a) TRUE

(b) FALSE

Q:8. A portfolio comprises of two stocks A and B. Stock A gives a return of 8% and stock B gives a return of 7%. Stock A has a weight of 60% in the portfolio. What is the portfolio return? [2 Marks]

(a) 9%

(b) 11%

(c) 10%

(d) 8%

Q:9. Evidence accumulated through research over the past two decades suggests that during many episodes the markets are not efficient even in the weak form. [2 Marks]

(a) FALSE

(b) TRUE

Q:10. Mr. A buys a Put Option at a strike price of Rs. 100 for a premium of Rs. 5. On expiry of the contract the underlying shares are trading at Rs. 106. Will Mr. A exercise his option? [3 Marks]

(a) No

(b) Yes

Q:11. Price movement between two Information Technology stocks would generally have a _____ co-variance. [1 Mark]

(a) zero

(b) positive

(c) negative

Q:12. In the case of callable bonds, the callable price (redemption price) may be different from the face value. [2 Marks]

(a) FALSE

(b) TRUE

Q:13. Term structure of interest rates is also called as the _____. [2 Marks]

(a) term curve

(b) yield curve

(c) interest rate curve

(d) maturity curve

Q:14. Each investment company is run by an _____. [1 Mark]

(a) asset deployment company

(b) revenue management company

(c) asset management company

(d) asset reconstruction company

Q:15. A _____, is a time deposit with a bank with a specified interest rate. [1 Mark]

(a) certificate of deposit (CD)

(b) commercial paper (CP)

(c) T-Note

(d) T-Bill

Q:16. Prices (returns) which are not according to CAPM shall be quickly identified by the market and brought back to the _____. [1 Mark]

(a) average

(b) standard deviation

(c) mean

(d) equilibrium

Q:17. Net acquisitions / disposals appears in the Cash Flow Statement of Companies. [3 Marks]

(a) TRUE

(b) FALSE

Q:18. _____ are a fixed income security. [1 Mark]

(a) Equities

(b) Forex

(c) Derivatives

(d) Bonds

Q:19. Investment advisory firms manage _____. [1 Mark]

(a) each client's account seperately

(b) all clients accounts in a combined manner

(c) only their own money and not client's money

Q:20. **_____ measures the percentage of net income not paid to the shareholders in the form of dividends.** **[1 Mark]**

(a) Withholding ratio

(b) Retention ratio

(c) Preservation ratio

(d) Maintenance ratio

Q:21. **In a Bond the ____ is paid at the maturity date.** **[1 Mark]**

(a) face value

(b) discounted value

(c) compounded value

(d) present value

Q:22. **Banks and other financial institutions generally create a portfolio of fixed income securities to fund known _____ .** **[2 Marks]**

(a) assets

(b) liabilities

Q:23. **Which of the following accounting statements form the backbone of financial analysis of a company?** **[1 Mark]**

(a) the income statement (profit & loss),

(b) the balance sheet

(c) statement of cash flows

(d) All of the above

Q:24. **The balance sheet of a company is a snapshot of the _____ of the firm at a point in time.** **[2 Marks]**

(a) the sources and applications of funds of the company.

(b) expenditure structure

(c) profit structure

(d) income structure

Q:25. **The need to have an understanding about the ability of the market to imbibe information into the prices has led to countless attempts to study and characterize the levels of efficiency of different segments of the financial markets.** **[1 Mark]**

(a) TRUE

(b) FALSE

Q:26. In investment decisions, _____ refers to the marketability of the asset.

[2 Marks]

(a) value

(b) profitability

(c) price

(d) liquidity

Q:27. Mr. A buys a Call Option at a strike price of Rs. 700 for a premium of Rs. 5. Mr. A expects the price of the underlying shares to rise above Rs. _____ on expiry date in order to make a profit. [3 Marks]

(a) 740

(b) 700

(c) 720

(d) 760

Q:28. The _____ refers to the length of time for which an investor expects to remain invested in a particular security or portfolio, before realizing the returns. [2 Marks]

(a) investment horizon

(b) credit cycle horizon

(c) duration horizon

(d) constraint horizon

Q:29. A _____ provides an account of the total revenue generated by a firm during a period (usually a financial year, or a quarter). [1 Mark]

(a) Accounting analysis statement

(b) financial re-engineering statement

(c) promotional expenses statement

(d) profit & loss statement

Q:30. New stocks/bonds are sold by the issuer to the public in the _____ . [1 Mark]

(a) fixed income market

(b) secondary market

(c) money market

(d) primary market

Q:31. Security of ABC Ltd. trades in the spot market at Rs. 525. Money can be invested at 10% per annum. The fair value of a one-month futures contract on ABC Ltd. is (using continously compounded method): [2 Marks]

(a) 559.46

(b) 549.46

(c) 539.46

(d) 529.46

Q:32. If the market is _____, the period after a favorable (unfavorable) event would not generate returns beyond (less than) what is suggested by an equilibrium model such as CAPM. [1 Mark]

(a) weak-form efficient

(b) strong form efficient

(c) semi-strong form efficient

Q:33. A sell order comes into the trading system at a Limit Price of Rs. 120. The order will get executed at a price of _____. [2 Marks]

(a) Rs. 120 or more

(b) Rs. 120 or less

Q:34. _____ have precedence over common stock in terms of dividend payments, and the residual claim to its assets in the event of liquidation. [1 Mark]

(a) Preferred shares

(b) Equity shares

Q:35. One needs to average out the time to maturity and time to various coupon payments to find the effective maturity for a bond. The measure is called as _____ of a bond. [2 Marks]

(a) duration

(b) IRR

(c) YTM

(d) yield

Q:36. In case of compound interest rate, we need to know the _____ for which compounding is done. [1 Mark]

(a) period

(b) frequency

(c) time

(d) duration

Q:37. Net change in Working Capital appears in the Cash Flow Statement of Companies. [3 Marks]

(a) FALSE

(b) TRUE

Q:38. A company's net income for a period is Rs. 15,00,00,000 and the average shareholder's fund during the period is Rs. 1,00,00,00,000. The Return on Average Equity is : [3 Marks]

(a) 13%

(b) 12%

(c) 15%

(d) 16%

Q:39. A portfolio comprises of two stocks A and B. Stock A gives a return of 14% and stock B gives a return of 1%. Stock A has a weight of 60% in the portfolio. What is the portfolio return? [2 Marks]

(a) 10%

(b) 9%

(c) 12%

(d) 11%

Q:40. Average Return of an investor's portfolio is 10%. The risk free return for the market is 8%. The Beta of the investor's portfolio is 1.2. Calculate the Treynor Ratio. [3 Marks]

(a) 4

(b) 8

(c) 2

(d) 6

Q:41. The share price of PQR Company on 1st April 2009 and 31st March 2010 is Rs. 20 and Rs. 24 respectively. The company paid a dividend of Rs. 5 for the year 2009-10. Calculate the return for a shareholder of PQR Company in the year 2009-10. [1 Mark]

(a) 45%

(b) 65%

(c) 75%

(d) 55%

Q:42. Portfolio management is the art of managing the expected _____ requirement for the corresponding _____. [1 Mark]

(a) income, expenditure

(b) gain, losses

(c) profit, loss tolerance

(d) return, risk tolerance

Q:43. Average Return of an investor's portfolio is 55%. The risk free return for the market is 8%. The Beta of the investor's portfolio is 1.2. Calculate the Treynor Ratio. [3 Marks]

(a) 41

(b) 39

(c) 43

(d) 45

Q:44. In addition to the perceived benefits of professional fund management, the major reason of investment into funds is the _____ they afford the investor. [1 Mark]

(a) specialisation

(b) diversification

(c) variety

(d) expansion

Q:45. ABC Ltd. has paid a dividend of Rs. 10 per share last year and it is expected to grow at 5% every year. If an investor's expected rate of return from ABC Ltd. share is 7%, calculate the market price of the share as per the dividend discount model. [2 Marks]

(a) 540

(b) 530

(c) 525

(d) 535

Q:46. The CAPM is founded on the following two assumptions (1) in the equilibrium every mean variance investor holds the same market portfolio and (2) the only risk the investor faces is the beta. [1 Mark]

(a) TRUE

(b) FALSE

Q:47. Markets are inefficient when prices of securities assimilate and reflect information about them. [1 Mark]

(a) TRUE

(b) FALSE

Q:48. Stock returns are generally expected to be independent across weekdays, but a number of studies have found returns on Monday to be lower than in the rest of the week. This departure from market efficiency is also sometimes called the _____ effect. [2 Marks]

(a) Monday-Friday

(b) weekday

(c) Monday

(d) weekend

Q:49. Over pricing in a stock presents an opportunity to engage in _____ the stock. [2 Marks]

(a) short covering

(b) short selling

(c) active buying

(d) going long

Q:50. What is the amount an investor will get on a 1-year fixed deposit of Rs. 10000 that pays 8% interest compounded quarterly? [1 Mark]

(a) 12824.32

(b) 13824.32

(c) 10824.32

(d) 11824.32

Q:51. For longer investment horizons investors look at _____ . [2 Marks]

(a) riskier assets like equities.

(b) low risk assets like government securities.

Q:52. Dividend Per Share = Total Dividend / Number of Shares in issue [1 Mark]

(a) TRUE

(b) FALSE

Q:53. Price movement between two Steel company stocks would generally have a _____ co-variance. [1 Mark]

(a) positive

(b) negative

(c) zero

Q:54. The price of a derivative is dependent on the price of another security, called the _____ . [1 Mark]

(a) basis

(b) variable

(c) underlying

(d) options

Q:55. Call Options can be classified as : [1 Mark]

(a) European

(b) American

(c) All of the above

Q:56. In India, Commercial Papers (CPs) can be issued by _____. [3 Marks]

(a) Mutual Fund Agents

(b) Insurance Agents

(c) Primary Dealers

(d) Sub-Brokers

Q:57. An endowment fund is an institutional investor. [1 Mark]

(a) FALSE

(b) TRUE

Q:58. _____ orders are activated only when the market price of the relevant security reaches a threshold price. [2 Marks]

(a) Limit

(b) Market-loss

(c) Stop-loss

(d) IOC

Q:59. A portfolio comprises of two stocks A and B. Stock A gives a return of 9% and stock B gives a return of 6%. Stock A has a weight of 60% in the portfolio. What is the portfolio return? [2 Marks]

(a) 11%

(b) 9%

(c) 10%

(d) 8%

Q:60. The issue price of T-bills is generally decided at an _____ . [3 Marks]

(a) OTC market

(b) inter-bank market

(c) exchange

(d) auction

Correct Answers :

Question No.	Answers	Question No.	Answers
1	(a)	31	(d)
2	(b)	32	(c)
3	(b)	33	(a)
4	(c)	34	(a)
5	(b)	35	(a)
6	(c)	36	(b)
7	(a)	37	(b)
8	(d)	38	(c)
9	(b)	39	(b)
10	(a)	40	(c)
11	(b)	41	(a)
12	(b)	42	(d)
13	(b)	43	(b)
14	(c)	44	(b)
15	(a)	45	(c)
16	(d)	46	(a)
17	(a)	47	(b)
18	(d)	48	(d)
19	(a)	49	(b)
20	(b)	50	(c)
21	(a)	51	(a)
22	(b)	52	(a)
23	(d)	53	(a)
24	(a)	54	(c)
25	(a)	55	(a)
26	(d)	56	(c)
27	(b)	57	(b)
28	(a)	58	(c)
29	(d)	59	(d)
30	(d)	60	(d)
