TEERTHANKER MAHAVEER UNIVERSITY
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CENTRE FOR ONLINE & DISTANCE LEARNING

Programme: Bachelor of Arts (Economics)
Semester-III

Course: Financial Economics

Syllabus

Module I:Investment Theory and Structure of Interest rates

Introduction to financial economics, Time Value of Money: Future Value, Present Value, Future value of an annuity, Present value of annuity, Present rate of perpetuity. Investment Criteria: Net Present Value, Benefit Cost Ratio, Internal Rate of Return, Modified Internal Rate of Return.

Module II: Valuation of Bonds and Securities

Fundamentals of Valuation of Securities: Valuation of Bonds and Stocks; Bond Yield, Yield to Maturity. Equity Valuation: Dividend Discount Model, The P/E Ratio Approach; Irrelevance of Dividends: Modigliani and Miller Hypothesis.

Module III: Risk and Return

Types of risk, Historical returns and Risk, computing historical returns, average annual returns, variance of returns, Measurement of Risk and Return of an asset, Measurement of Risk and Return of a Portfolio, Determinants of Beta, Risk-Return trade off.

Module IV: Cost of Capital and Capital Asset Pricing Model

The Cost of Capital: Debt and equity; Cost of Debt, Cost of Preference Capital and Equity Capital. The capital market line; the capital asset pricing model; the beta of an asset and of a portfolio; security market line; use of the CAPM model in investment analysis and as a pricing formula.

Module V:Derivative Markets

An introduction to financial derivatives: Types and uses of derivatives; Forward Contracts: determination of forward prices, Futures Contract: theories of future prices- the cost of carry model, the expectation model, capital asset pricing model. Relation between Spot and Future Prices, forward vs future contract, Hedging in Futures; Options: types, value of an option, the Pay-Offs from Buying and Selling of Options; the Put Call Parity Theorem; Binomial option pricing model (BOPM) and Black-Scholes option pricing model.

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Module I:
Investment Theory and Structure of Interest rates

1.1. Financial Economics

Financial economics is a branch of economics that analyzes the use and distribution of resources in markets. Financial decisions must often take into account future events, whether those be related to individual stocks, portfolios, or the market as a whole. It employs economic theory to evaluate how time, risk, opportunity costs, and information can create incentives or disincentives for a particular decision. Financial economics often involves the creation of sophisticated models to test the variables affecting a particular decision.

Financial economics necessitates familiarity with basic probability and statistics since these are the standard tools used to measure and evaluate risk. Financial economics studies fair value, risk and returns, and the financing of securities and assets. Numerous monetary factors are taken into account, too, including interest rates and inflation.

1.2. Time Value of Money

Time value of money (TVM) is the idea that money that is available at the present time is worth more than the same amount in the future, due to its potential earning capacity. This core principle of finance holds that provided money can earn interest, any amount of money is worth more the sooner it is received. One of the most fundamental concepts in finance is that money has a time value attached to it. In simpler terms, it would be safe to say that a dollar was worth more yesterday than today and a dollar today is worth more than a dollar tomorrow. This is because money can grow only through investing. An investment delayed is an opportunity lost. The time value of money is also referred to as present discounted value. The formula for computing the time value of money considers the amount of money, its future value, the amount it can earn, and the time frame.

In general, the most fundamental TVM formula takes into account the following variables:

Present value (PV) - This is your current starting amount. It is the money you have in your hand at the present time, your initial investment for your future.

Future value (FV) - This is your ending amount at a point in time in the future. It should be worth more than the present value, provided it is earning interest and growing over time.

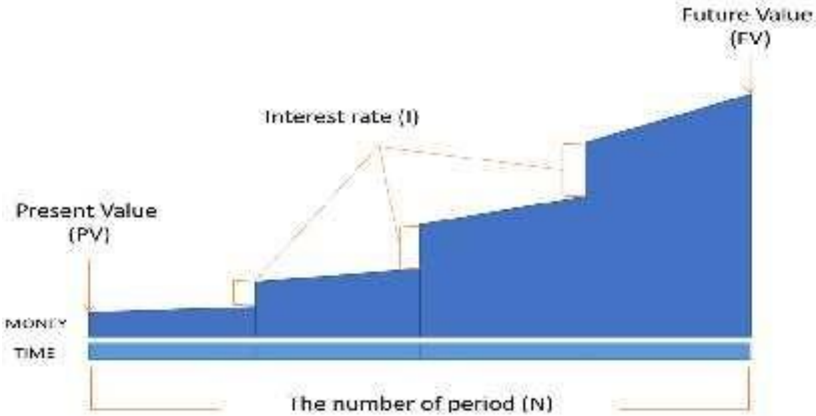
The number of periods (N) - This is the timeline for your investment (or debts). It is usually measured in years, but it could be any scale of time such as quarterly, monthly, or even daily.

Interest rate (I) - This is the growth rate of your money over the lifetime of the investment. It is stated in a percentage value, such as 8% or .08.

Payment amount (PMT) - These are a series of equal, evenly-spaced cash flows.

Based on these variables, the formula for TVM is:

$$FV = PV \times [1 + \frac{i}{n}^{(n \times t)}$$



A simple example of this would be: If you invest one dollar (PV) for one year (N) at 6% (I), you will receive $1.06 (FV). This would be the same as saying the present value of $1.06 you expect to receive in one year, is only $1.00 (PV).

Examples: Assume a sum of $10,000 is invested for one year at 10% interest compounded annually. The future value of that money is:

FV = $10,000 x [1 + (10% / 1)] ^ (1 x 1) = $11,000

The formula can also be rearranged to find the value of the future sum in present day dollars. For example, the present day dollar amount compounded annually at 7% interest that would be worth $5,000 one year from today is:

PV = $5,000 / [1 + (7% / 1)] ^ (1 x 1) = $4,673

- The Time Value of Money Relate to Opportunity Cost

Opportunity cost is key to the concept of the time value of money. Money can grow only if it is invested over time and earns a positive return. Money that is not invested loses value over time. Therefore, a sum of money that is expected to be paid in the future, no matter how confidently it is expected, is losing value in the meantime.

- Significance of Time Value of Money

The concept of the time value of money can help guide investment decisions. For instance, suppose an investor can choose between two projects: Project A and Project B. They are identical except that Project A promises a $1 million cash payout in year one, whereas Project B offers a $1 million cash payout in year five. The payouts are not equal. The $1 million payout received after one year has a higher present value than the $1 million payout after five years.

- Use of Time Value of Money in Finance

It would be hard to find a single area of finance where the time value of money does not influence the decision-making process. The time value of money is the central concept in discounted cash flow (DCF) analysis, which is one of the most popular and influential methods for valuing investment opportunities. It is also an integral part of financial planning and risk management activities. Pension fund managers, for instance, consider the time value of money to ensure that their account holders will receive adequate funds in retirement.

1.3. Future Value

Future value (FV) is the value of a current asset at a future date based on an assumed rate of growth. The future value is important to investors and financial planners, as they use it to estimate how much an investment made today will be worth in the future. Knowing the future value enables investors to make sound investment decisions based on their anticipated needs. However, external economic factors, such as inflation, can adversely affect the future value of the asset by eroding its value. The FV calculation allows investors to predict, with varying degrees of accuracy, the amount of profit that can be generated by different investments. The amount of growth generated by holding a given amount in cash will likely be different than if that same amount were invested in stocks; therefore, the FV equation is used to compare multiple options.

Determining the FV of an asset can become complicated, depending on the type of asset. Also, the FV calculation is based on the assumption of a stable growth rate. If money is placed in a savings account with a guaranteed interest rate, then the FV is easy to determine accurately. However, investments in the stock market or other securities with a more volatile rate of return can present greater difficulty. To understand the core concept, however, simple and compound interest rates are the most straightforward examples of the FV calculation.

Types of Future Value

Future Value Using Simple Annual Interest

The FV formula assumes a constant rate of growth and a single up-front payment left untouched for the duration of the investment. The FV calculation can be done one of two ways, depending on the type of interest being earned. If an investment earns simple interest, then the FV formula is:

$$FV = I \times (1 + (R \times T))$$

Where: I=Investment amount, R=Interest rate, T=Number of years

For example, assume a $1,000 investment is held for five years in a savings account with 10% simple interest paid annually. In this case, the FV of the $1,000 initial investment is $1,000 × [1 + (0.10 x 5)], or $1,500.

Future Value Using Compounded Annual Interest

With simple interest, it is assumed that the interest rate is earned only on the initial investment. With compounded interest, the rate is applied to each period's cumulative account balance. In the example above, the first year of investment earns 10% × $1,000, or $100, in interest. The following year, however, the account total is $1,100 rather than $1,000; so, to calculate compounded interest, the 10% interest rate is applied to the full balance for second-year interest earnings of 10% × $1,100, or $110.

The formula for the FV of an investment earning compounding interest is:

$$FV = I \times (1 + R)^T$$

Where**:** *I*=Investment amount, *R*=Interest rate, *T*=Number of years

Using the above example, the same $1,000 invested for five years in a savings account with a 10% compounding interest rate would have an FV of $1,000 × [(1 + 0.10)^5], or $1,610.51.

1.4. Present Value

Present value (PV) is the current value of a future sum of money or stream of cash flows given a specified rate of return. The concept that states an amount of money today is worth more than that same amount in the future. In other words, money received in the future is not worth as much as an equal amount received today. Receiving $1,000 today is worth more than $1,000 five years from now. An investor can invest the $1,000 today and presumably earn a rate of return over the next five years. Present value takes into account any interest rate an investment might earn. For example, if an investor receives $1,000 today and can earn a rate of return 5% per year, the $1,000 today is certainly worth more than receiving $1,000 five years from now. If an investor waited five years for $1,000, there would be an opportunity cost or the investor would lose out on the rate of return for the five years.

Inflation is the process in which prices of goods and services rise over time. If you receive money today, you can buy goods at today's prices. Presumably, inflation will cause the price of goods to rise in the future, which would lower the purchasing power of your money.

Money not spent today could be expected to lose value in the future by some implied annual rate, which could be inflation or the rate of return if the money was invested. The present value formula discounts the future value to today's dollars by factoring in the implied annual rate from either inflation or the rate of return that could be achieved if a sum was invested.

Discount Rate for Finding Present Value

The discount rate is the investment rate of return that is applied to the present value calculation. In other words, the discount rate would be the forgone rate of return if an investor chose to accept an amount in the future versus the same amount today. The discount rate that is chosen for the present value calculation is highly subjective because it's the expected rate of return you'd receive if you had invested today's dollars for a period of time.

The discount rate is the sum of the time value and a relevant interest rate that mathematically increases future value in nominal or absolute terms. Conversely, the discount rate is used to work out future value in terms of present value, allowing a lender to settle on the fair amount of any future earnings or obligations in relation to the present value of the capital. The word "discount" refers to future value being discounted to present value.

The calculation of discounted or present value is extremely important in many financial calculations. For example, net present value, bond yields, and pension obligations all rely on discounted or present value. Learning how to use a financial calculator to make present value calculations can help you decide whether you should accept such offers as a cash rebate, 0% financing on the purchase of a car, or pay points on a mortgage.

PV Formula and Calculation

$$Present\ value = \frac{FV}{(1+r)^n}$$

Where, FV=Future Value; r=Rate of return; n=Number of periods

- Input the future amount that you expect to receive in the numerator of the formula.
- Determine the interest rate that you expect to receive between now and the future and plug the rate as a decimal in place of "r" in the denominator.
- Input the time period as the exponent "n" in the denominator. So, if you want to calculate the present value of an amount you expect to receive in three years, you would plug the number three in for "n" in the denominator.

Future Value vs. Present Value

A comparison of present value with future value (FV) best illustrates the principle of the time value of money and the need for charging or paying additional risk-based interest rates. Simply put, the money today is worth more than the same money tomorrow because of the passage of time. Future value can relate to the future cash inflows from investing today's money, or the future payment required to repay money borrowed today.

Future value (FV) is the value of a current asset at a specified date in the future based on an assumed rate of growth. The FV equation assumes a constant rate of growth and a single upfront payment left untouched for the duration of the investment. The FV calculation allows investors to predict, with varying degrees of accuracy, the amount of profit that can be generated by different investments.

Present value (PV) is the current value of a future sum of money or stream of cash flows given a specified rate of return. Present value takes the future value and applies a discount rate or the interest rate that could be earned if invested. Future value tells you what an investment is worth in the future while the present value tells you how much you'd need in today's dollars to earn a specific amount in the future.

1.5. Annuity

Annuities are financial products that offer a guaranteed income stream, usually for retirees. The accumulation phase is the first stage of an annuity, whereby investors fund the product with either a lump-sum or periodic payments. The annuitant begins receiving payments after the annuitization period for a fixed period or for the rest of their life. Annuities can be structured into different kinds of instruments, which gives investors flexibility.

These products can be categorized into immediate and deferred annuities, and may be structured as fixed or variable.

Types of Annuities

Annuities can be structured according to a wide array of details and factors, such as the duration of time that payments from the annuity can be guaranteed to continue. Annuities can be created so that payments continue so long as either the annuitant or their spouse (if survivorship benefit is elected) is alive. Alternatively, annuities can be structured to pay out funds for a fixed amount of time, such as 20 years, regardless of how long the annuitant lives.

- **Immediate and Deferred Annuities**

Annuities can begin immediately upon deposit of a lump sum, or they can be structured as deferred benefits. The immediate payment annuity begins paying immediately after the annuitant deposits a lump sum. Deferred income annuities, on the other hand, don't begin paying out after the initial investment. Instead, the client specifies an age at which they would like to begin receiving payments from the insurance company.

- **Fixed and Variable Annuities**

Annuities can be structured generally as either fixed or variable: Fixed annuities provide regular periodic payments to the annuitant. Variable annuities allow the owner to receive larger future payments if investments of the annuity fund do well and smaller payments if its investments do poorly, which provides for less stable cash flow than a fixed annuity but allows the annuitant to reap the benefits of strong returns from their fund's investments.

While variable annuities carry some market risk and the potential to lose principal, riders and features can be added to annuity contracts—usually for an extra cost. This allows them to function as hybrid fixed-variable annuities. Contract owners can benefit from upside portfolio potential while enjoying the protection of a guaranteed lifetime minimum withdrawal benefit if the portfolio drops in value.

1.6. The Present Value of an annuity

The present value of an annuity is the current value of future payments from an annuity, given a specified rate of return, or discount rate. The higher the discount rate, the lower the present value of the annuity. The present value of an annuity refers to how much money would be needed today to fund a series of future annuity payments. Because of the time value of money, a sum of money received today is worth more than the same sum at a future date.

The formula for the present value of an ordinary annuity, as opposed to an annuity due, is below. (An ordinary annuity pays interest at the end of a particular period, rather than at the beginning, as is the case with an annuity due.)

$$P = PMT \times \frac{1 - \left(\frac{1}{(1+r)^n}\right)}{r}$$

Where: P=Present value of an annuity stream

PMT=Dollar amount of each annuity payment

r=Interest rate (also known as discount rate)

n=Number of periods in which payments will be made

Future Value of an Annuity

The future value of an annuity is a way of calculating how much money a series of payments will be worth at a certain point in the future. By contrast, the present value of an annuity measures how much money will be required to produce a series of future payments. In an ordinary annuity, payments are made at the end of each agreed-upon period. In an annuity due, payments are made at the beginning of each period.

Because of the time value of money, money received or paid out today is worth more than the same amount of money will be in the future. That's because the money can be invested and allowed to grow over time. By the same logic, a lump sum of $5,000 today is worth more than a series of five $1,000 annuity payments spread out over five years.

The formula for the future value of an ordinary annuity is as follows. (An ordinary annuity pays interest at the end of a particular period, rather than at the beginning, as is the case with an annuity due.)

$$P = PMT \times \frac{((1+r)^n - 1)}{r}$$

where: P=Future value of an annuity stream

PMT=Dollar amount of each annuity payment

r=Interest rate (also known as discount rate)

n=Number of periods in which payments will be made

1.8. Present Rate of Perpetuity

An annuity is a stream of cash flows. A perpetuity is a type of annuity that lasts forever, into perpetuity. The stream of cash flows continues for an infinite amount of time. In finance, a person uses the perpetuity calculation in valuation methodologies to find the present value of a company's cash flows when discounted back at a certain rate.

A perpetuity is a security that pays for an infinite amount of time. In finance, perpetuity is a constant stream of identical cash flows with no end. The concept of perpetuity is also used in several financial theories, such as in the dividend discount model (DDM). An infinite series of cash flows can have a finite present value. Because of the time value of money, each payment is only a fraction of the last. The present value of a perpetuity is determined by dividing cash flows by the discount rate. Specifically, the perpetuity formula determines the amount of cash flows in the terminal year of operation. In valuation, a company is said to be a going concern, meaning that it goes on forever. For this reason, the terminal year is a perpetuity, and analysts use the perpetuity formula to find its value.

$$PV = \frac{C}{(1+r)^1} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} \dots = \frac{C}{r}$$

where: PV=present value; C=cash flow; r=discount rate

The basic method used to calculate a perpetuity is to divide cash flows by some discount rate. The formula used to calculate the terminal value in a stream of cash flows for valuation purposes is a bit more complicated. It is the estimate of cash flows in year 10 of the company, multiplied by one plus the company’s long-term growth rate, and then divided by the difference between the cost of capital and the growth rate. Simply put, the terminal value is some amount of cash flows divided by some discount rate, which is the basic formula for a perpetuity.

1.7. Investment criteria

Investment criteria are the defined set of parameters used by financial and strategic buyers to assess an acquisition target. Sophisticated buyers will usually have two sets of criteria:

The parameters that are disclosed publicly to intermediaries such as investment bankers, so they know what the buyer is looking for in order to source deals that fit; and The parameters developed for internal review that allow a buyer to quickly determine if the acquisition should be pursued further. The most common publicly disclosed investment criteria include the geography, size of the investment or company targeted, and industry. Some buyers also disclose criteria regarding the investment type which may include management buyouts (MBO), distressed opportunities, or succession situations.

- **Net Present Value**

Net present value, or NPV, is used to calculate the current total value of a future stream of payments. In other words, Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. If the NPV of a project or investment is positive, it means that the discounted present value of all future cash flows related to that project or investment will be positive, and therefore attractive. To calculate NPV, you need to estimate future cash flows for each period and determine the correct discount rate.

NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.

NPV is the result of calculations used to find today's value of a future stream of payments.

$$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t}$$

Where: R_t = Net cash inflow –outflow during a single period t; i = Discount rate or return that could be earned in alternative investments; t = Number of timer periods

In theory, an NPV is "good" if it is greater than zero. After all, the NPV calculation already takes into account factors such as the investor's cost of capital, opportunity cost, and risk tolerance through the discount rate. And the future cash flows of the project, together with the time value of money, are also captured. Therefore, even an NPV of ₹1 should theoretically qualify as "good."

Positive and Negative NPV

A positive NPV indicates that the projected earnings generated by a project or investment—in present dollars—exceeds the anticipated costs, also in present dollars. It is assumed that an investment with a positive NPV will be profitable.

An investment with a negative NPV will result in a net loss. This concept is the basis for the Net Present Value Rule, which dictates that only investments with positive NPV values should be considered.

- **Benefit-Cost Ratio (BRC)**

A benefit-cost ratio (BCR) is a ratio used in a cost-benefit analysis to summarize the overall relationship between the relative costs and benefits of a proposed project. BCR can be expressed in monetary or qualitative terms. A benefit-cost ratio (BCR) is an indicator showing the relationship between the relative costs and benefits of a proposed project, expressed in monetary or qualitative terms. If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value to a firm and its investors. If a project's BCR is less than 1.0, the project's costs outweigh the benefits, and it should not be considered.

Benefit-cost ratios (BCRs) are most often used in capital budgeting to analyze the overall value for money of undertaking a new project. However, the cost-benefit analyses for large projects can be hard to get right, because there are so many assumptions and uncertainties that are hard to quantify. This is why there is usually a wide range of potential BCR outcomes.

The BCR also does not provide any sense of how much economic value will be created, and so the BCR is usually used to get a rough idea about the viability of a project and how much the internal rate of return (IRR) exceeds the discount rate, which is the company's weighted-average cost of capital (WACC) – the opportunity cost of that capital.

The BCR is calculated by dividing the proposed total cash benefit of a project by the proposed total cash cost of the project. Prior to dividing the numbers, the net present value of the respective cash flows over the proposed lifetime of the project – taking into account the terminal values, including salvage/remediation costs – are calculated.

Limitations of BCR

The primary limitation of the BCR is that it reduces a project to a simple number when the success or failure of an investment or expansion relies on many factors and can be undermined by unforeseen events. Simply following a rule that above 1.0 means success and below 1.0 spells failure is misleading and can provide a false sense of comfort with a project. The BCR must be used as a tool in conjunction with other types of analysis to make a well-informed decision.

- **The internal rate of return (IRR)**

The internal rate of return (IRR) is a discounting cash flow technique which gives a rate of return earned by a project. The internal rate of return is the discounting rate where the total of initial cash outlay and discounted cash inflows are equal to zero. In other words, it is the discounting rate at which the net present value (NPV) is equal to zero. It is the rate of return at which the net present value of a project becomes zero. They call it ‘internal’ because it does not take any external factor (like inflation) into consideration.

The internal rate of return (IRR) determines the worthiness of any project. In addition, the IRR determines the efficiency of a project in generating profits. Therefore, companies use the metric to plan before investing in any project. The hurdle rate or required rate of return is a minimum return expected by an organization on its investment. Any project with an internal rate of return exceeding the hurdle rate is considered profitable. It is expressed in the form of percentage return a firm expects from the project.

The internal rate of return (IRR) is a metric used in financial analysis to estimate the profitability of potential investments. IRR is a discount rate that makes the net present value (NPV) of all cash flows equal to zero in a discounted cash flow analysis.

Generally speaking, the higher an internal rate of return, the more desirable an investment is to undertake. IRR is uniform for investments of varying types and, as such, can be used to rank multiple prospective investments or projects on a relatively even basis. In general, when comparing investment options with other similar characteristics, the investment with the highest IRR probably would be considered the best.

The formula and calculation used to determine this figure are as follows:

$$0 = NPV = \sum_{t=1}^{T} \frac{C_t}{(1 + IRR)^t} - C_0$$

Where: C_t = Net cash inflow during the period t; C_0 = Total initial investment costs; IRR = The internal rate of return; t = The number of time periods.

The ultimate goal of IRR is to identify the rate of discount, which makes the present value of the sum of annual nominal cash inflows equal to the initial net cash outlay for the investment. Several methods can be used when seeking to identify an expected return, but IRR is often ideal for analyzing the potential return of a new project that a company is considering undertaking.

Think of IRR as the rate of growth that an investment is expected to generate annually. Thus, it can be most similar to a compound annual growth rate (CAGR). In reality, an investment will usually not have the same rate of return each year. Usually, the actual rate of return that a given investment ends up generating will differ from its estimated IRR.

Uses of IRR

- In capital planning, one popular scenario for IRR is comparing the profitability of establishing new operations with that of expanding existing operations.

- IRR is also useful for corporations in evaluating stock buyback programs.
- Individuals can also use IRR when making financial decisions—for instance, when evaluating different insurance policies using their premiums and death benefits.
- Another common use of IRR is in analyzing investment returns.
- IRR is a calculation used for an investment's money-weighted rate of return (MWRR). The MWRR helps determine the rate of return needed to start with the initial investment amount factoring in all of the changes to cash flows during the investment period, including sales proceeds.

Modified Internal Rate of Return (MIRR)

The modified internal rate of return (MIRR) assumes that positive cash flows are reinvested at the firm's cost of capital and that the initial outlays are financed at the firm's financing cost. By contrast, the traditional internal rate of return (IRR) assumes the cash flows from a project are reinvested at the IRR itself. The MIRR, therefore, more accurately reflects the cost and profitability of a project.

Formula and Calculation of MIRR

Given the variables, the formula for MIRR is expressed as:

$$MIRR = \sqrt[n]{\frac{FV(Positive\ cash\ flows \times Cost\ of\ capital)}{PV(Initial\ outlays \times Financing\ cost)}} - 1$$

where:

FVCF(c)=the future value of positive cash flows at the cost of capital for the company

PVCF(fc)=the present value of negative cash flows at the financing cost of the company

n=number of periods

Meanwhile, the internal rate of return (IRR) is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. Both MIRR and IRR calculations rely on the formula for NPV.

The MIRR is used to rank investments or projects of unequal size. The calculation is a solution to two major problems that exist with the popular IRR calculation. The first main problem with IRR is that multiple solutions can be found for the same project. The second problem is that the assumption that positive cash flows are reinvested at the IRR is considered impractical in practice. With the MIRR, only a single solution exists for a given project, and the reinvestment rate of positive cash flows is much more valid in practice.

The MIRR allows project managers to change the assumed rate of reinvested growth from stage to stage in a project. The most common method is to input the average estimated cost of capital, but there is flexibility to add any specific anticipated reinvestment rate.

- The Difference Between MIRR and IRR

Even though the internal rate of return (IRR) metric is popular among business managers, it tends to overstate the profitability of a project and can lead to capital budgeting mistakes based on an overly optimistic estimate. The modified internal rate of return (MIRR) compensates for this flaw and gives managers more control over the assumed reinvestment rate from future cash flow.

An IRR calculation acts like an inverted compounding growth rate. It has to discount the growth from the initial investment in addition to reinvested cash flows. However, the IRR does not paint a realistic picture of how cash flows are actually pumped back into future projects.

Cash flows are often reinvested at the cost of capital, not at the same rate at which they were generated in the first place. IRR assumes that the growth rate remains constant from project to project. It is very easy to overstate potential future value with basic IRR figures.

Another major issue with IRR occurs when a project has different periods of positive and negative cash flows. In these cases, the IRR produces more than one number, causing uncertainty and confusion. MIRR solves this issue as well.

Advantages of IRR

- Finds the Time Value of Money

Internal rate of return is measured by calculating the interest rate at which the present value of future cash flows equals the required capital investment. The timing of cash flows in all future years are considered and, therefore, each cash flow is given equal weight by using the time value of money.

- Simple to Use and Understand

The IRR is an easy measure to calculate and provides a simple means by which to compare the worth of various projects under consideration. The IRR provides any small business owner with a quick snapshot of what capital projects would provide the greatest potential cash flow. It can also be used for budgeting purposes such as to provide a quick snapshot of the potential value or savings of purchasing new equipment as opposed to repairing old equipment.

- Hurdle Rate Not Required

In capital budgeting analysis, the hurdle rate, or cost of capital, is the required rate of return at which investors agree to fund a project. It can be a subjective figure and typically ends up as a rough estimate. The IRR method does not require the hurdle rate, mitigating the risk of determining a wrong rate. Once the IRR is calculated, projects can be selected where the IRR exceeds the estimated cost of capital.

Disadvantage

- Ignores Size of Project

  It does not account for the project size when comparing projects. Cash flows are simply compared to the amount of capital outlay generating those cash flows. This can be troublesome when two projects require a significantly different amount of capital outlay, but the smaller project returns a higher IRR.

- Ignores Future Costs

The IRR method only concerns itself with the projected cash flows generated by a capital injection and ignores the potential future costs that may affect profit.

- Ignores Reinvestment Rates

The IRR allows you to calculate the value of future cash flows, it makes an implicit assumption that those cash flows can be reinvested at the same rate as the IRR. That assumption is not practical as the IRR is sometimes a very high number and opportunities that yield such a return are generally not available or significantly limited.

Module II
Valuation of Bonds and Securities

2.1. Valuation of securities

Valuation means professionally estimating, assessing, determining, setting the price, worth and value of a thing or an asset. As the objective of any investment is to find out an asset which is worth more than its cost, a proper understanding of the process of valuation is necessary for any real or financial investment decision, portfolio selection and management and financing decision. The valuation techniques provide investors a benchmark or standard of comparison be valued between assets and firms which have varying financial characteristics; it enables investors to appraise the relative attractiveness of assets and firms. Therefore, we discuss below certain (a) value concepts, (b) general principles of valuation and (c) the way in which certain specific securities can be valued.

Value Concepts

Book Value

The book value of an asset or a firm is based on accounting reports. In case of a physical asset, it is equal to the asset's historical cost less accumulated depreciation. In case of a common stock, it is equal to the net worth (paid-up capital + reserves and surplus) of the firm divided by the number of outstanding shares. Symbolically,

$$\text{Book value of physical asset} = \text{Historical cost} - \text{Accumulated depreciciation}$$

$$\text{Book value of physical asset} = \frac{\text{Networth(Paidup capital + Reservesves and surplus}}{\text{Number of outstanding shashares}}$$

Going-Concern Value

This concept applies to a business firm as a continuing operating unit. It is based primarily on how profitable a firm's operations would be as a continuing entity that is, the entity which is unlikely to go out of business in the foreseeable future.

Liquidation Value

In contrast to the going-concern value, the liquidation value is the value of the business firm which has cease or wound up its business, or which has gone into liquidation. The liquidation value of an ordinary share is equal to the value realised from liquidating all the assets of the firm minus the amount to be paid to all the creditors, preference shareholders, and other prior claimants divided by the number of outstanding ordinary shares.

Market Value

The market value of an asset is simply the price at which it is traded in the market at a given point of time.

Intrinsic or Present Value

Intrinsic value is also known as fair market value or investment value. It is equal to the present value of a stream of cash flows expected to be generated by the asset. The technique for finding out present value is known as discounting. Market value truly reflects intrinsic value if the market is perfectly competitive.

Terminal Value

The terminal value of the asset or money is the value of today's money at some point of time in future, and the method for ascertaining it is known as compounding.

Time Value of Money

It connotes that a rupee today in hand is worth more than a rupee tomorrow (in future) because it can be invested and made to earn interest immediately, and because the present consumption is valued more than the future consumption by the people.

General Principles of Valuation

Any asset or security derives its value from the cash flows it is expected to generate in future. The present value of the future or delayed pay-off can be found by multiplying that pay-off by the discount factor which is less than one and which can be expressed as follows:

$$Discount\ factor = \frac{1}{1 + Discount\ rate}$$

It follows that to obtain the value of the asset, we need to know two things. One, the expected or projected future cash flows; and two, the discount rate which is also known as the hurdle rate or the opportunity cost of investment. The discount rate is equal to the RRR which is approximated by the rate of return available on the next best opportunity for investment which the investor forgoes by investing in the asset in question. We illustrate below the basic valuation model by giving the present value formulae for only five types of future cash flows, although there is a wide range of possibilities in respect of the types of cash flows.

(i) Cash flow to be received at the end of one year:

$$PV = \frac{c_1}{(1+r_1)^1}$$

(ii) cash flow to be received at the end of the fifth year:

$$PV = \frac{c_5}{(1+r_5)^5}$$

(iii) continuous uneven (not the same) stream of cash flows to be received at the end of each year for a period of time:

$$PV = \frac{c_1}{(1+r_1)^1} + \frac{c_2}{(1+r_2)^2} + \cdots + \frac{c_n}{(1+r_n)^n}$$

$$or$$

$$PV = \sum_{t=1}^{n} \frac{c_t}{(1+r_t)^t}$$

(iv) Continuous even (fixed) stream of cash flows to be received at the end of each year for a given period of time. This is known as annuity which can be valued as follows:

$$Pv = \frac{c}{(1+r_1)^1} + \frac{c}{(1+r_2)^2} + \cdots + \frac{c}{(1+r_n)^n}$$

$$PV = \sum_{t=1}^{n} \frac{c}{(1+r_t)^t}$$

Or

$$PV = C \left[\frac{1}{r} - \frac{1}{r(1+r_t)^t}\right.$$

(v) Continuous even (fixed) stream of cash flows to be received indefinitely. This is known as perpetuity and can be valued as follows:

$$PV = \frac{c}{r}$$

In all of the above formulae,

PV= Present Value;

C=Cash flow;

t=End of the year (period);

n=Duration of cash flow; and

r=Discount rate.

The term r_t, in these equations implies that, in principle, there has to be a different discount rate for different future periods. The higher rate can be applied for the longer maturity. However, since normally a flat term structure of interest rates is assumed in this context, the term r_t, can be replaced by the term r. The level of PV of the asset depends upon the timing of the cash flow and the level of discount rate. Given the discount rate, the more further off the pay-off, the lower the PV. Similarly, given the timing the higher the discount rate, the lower the PV. Thus, the PV is inversely related to both the timing of the cash flow and the discount rate. Closely related to the concept of PV is that of Net Present Value (NPV), which is equal to

PV minus the required investment or the cash outflows (costs) associated with the investment.

$$TV = CI(1 + r)^t$$

$$TV = CI(1 + \frac{r}{m})^{mt}$$

2.2. Valuation of Bonds and Stocks

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

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

- Maturity date: All bonds have maturity dates, some short-term, others long-term. When a bond matures, the bond issuer repays the investor the full face value of the bond. For corporate bonds, the face value of a bond is usually $1,000 and for government bonds, the face value is $10,000. The face value is not necessarily the invested principal or purchase price of the bond.

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

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

Bond valuation is a technique for determining the theoretical fair value of a particular bond. Bond valuation includes calculating the present value of a bond's future interest payments, also known as its cash flow, and the bond's value upon maturity, also known as its face value or par value. Because a bond's par value and interest payments are fixed, an investor uses bond valuation to determine what rate of return is required for a bond investment to be worthwhile.

- Coupon Bond Valuation

Calculating the value of a coupon bond factors in the annual or semi-annual coupon payment and the par value of the bond. The present value of expected cash flows is added to the present value of the face value of the bond as seen in the following formula:

$$V_{coupons} = \sum \frac{C}{(1+r)^t}$$

$$V_{face\ value} = \frac{F}{(1+r)^T}$$

Where:

C= future cash flows, that is, coupon payment

r = discount rate, that is , yield to maturity

F = face value of the bond

t = number of periods

T = time to maturity

- Zero-Coupon Bond Valuation

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

Under both calculations, a coupon-paying bond is more valuable than a zero-coupon bond.

- Convertible Bonds Valuation

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

Stock Valuation

Stock valuation is a method of determining the intrinsic value (or theoretical value) of a stock. The importance of valuing stocks evolves from the fact that the intrinsic value of a stock is not attached to its current price. By knowing a stock's intrinsic value, an investor may determine whether the stock is over- or under-valued at its current market price. Valuing stocks is an extremely complicated process that can be generally viewed as a combination of both art and science. Investors may be overwhelmed by the amount of available information that can be potentially used in valuing stocks (company's financials, newspapers, economic reports, stock reports, etc.).

- Types of Stock Valuation

Stock valuation methods can be primarily categorized into two main types: absolute and relative.

1. Absolute

Absolute stock valuation relies on the company's fundamental information. The method generally involves the analysis of various financial information that can be found in or derived from a company's financial statements. Many techniques of absolute stock valuation primarily investigate the company's cash flows, dividends, and growth rates. Notable absolute stock valuation methods include the dividend discount model (DDM) and the discounted cash flow model (DCF).

2. Relative

Relative stock valuation concerns the comparison of the investment with similar companies. The relative stock valuation method deals with the calculation of the key financial ratios of similar companies and derivation of the same ratio for the target company. The best example of relative stock valuation is comparable companies analysis.

- Stock Valuation Methods

Below, we will briefly discuss the most popular methods of stock valuation.

1. Dividend Discount Model (DDM)

The dividend discount model is one of the basic techniques of absolute stock valuation. The DDM is based on the assumption that the company's dividends represent the company's cash flow to its shareholders. Essentially, the model states that the intrinsic value of the company's stock price equals the present value of the company's future dividends. Note that the dividend discount model is applicable only if a company distributes dividends regularly and the distribution is stable.

2. Discounted Cash Flow Model (DCF)

The discounted cash flow model is another popular method of absolute stock valuation. Under the DCF approach, the intrinsic value of a stock is calculated by discounting the company's free cash flows to its present value. The main advantage of the DCF model is that it does not require any assumptions regarding the distribution of dividends. Thus, it is suitable for companies with unknown or unpredictable dividend distribution. However, the DCF model is sophisticated from a technical perspective.

3. Comparable Companies Analysis

The comparable analysis is an example of relative stock valuation. Instead of determining the intrinsic value of a stock using the company's fundamentals, the comparable approach aims to derive a stock's theoretical price using the price multiples of similar companies. The most commonly used multiples include the price-to-earnings (P/E), price-to-book (P/B), and enterprise value-to-EBITDA (EV/EBITDA). The comparable companies analysis method is one of the simplest from a technical perspective. However, the most challenging part is the determination of truly comparable companies.

Bond Yield

Bond is an instrument to borrow money. A bond could be issued by a country's government or by a company to raise funds. A bond's yield refers to the expected earnings generated and realized on a fixed-income investment over a particular period of time, expressed as a percentage or interest rate. In other words, Bond yield is the return an investor realizes on a bond. The mathematical formula for calculating yield is the annual coupon rate divided by the current market price of the bond

When investors buy bonds, they essentially lend bond issuers money. In return, bond issuers agree to pay investors interest on bonds through the life of the bond and to repay the face value of bonds upon maturity. The simplest way to calculate a bond yield is to divide its coupon payment by the face value of the bond. This is called the coupon rate. Coupon Rate is the rate of interest paid by bond issuers on the bond's face value. If a bond is purchased for more than its face value (premium) or less than its face value (discount), which will change the yield an investor earns on the bond.

$$Coupon\ Rate = \frac{Annual\ Coupon\ Payment}{Bond\ Face\ Value}$$

As bond prices increase, bond yields fall. Its coupon rate is the interest divided by its par value.

If interest rates rise above 10%, the bond's price will fall if the investor decides to sell it. If the original bond owner wants to sell the bond, the price can be lowered so that the coupon payments and maturity value equal a yield of 12%. In this case, that means the investor would drop the price of the bond. If interest rates were to fall in value, the bond's price would rise because its coupon payment is more attractive. The further rates fall, the higher the bond's price will rise, and the same is true in reverse when interest rates rise. In either scenario, the coupon rate no longer has any meaning for a new investor. However, if the annual coupon payment is divided by the bond's price, the investor can calculate the current yield and get a rough estimate of the bond's true yield.

$$Current\ Yield = \frac{Annual\ Coupon\ Payment}{Bond\ Price}$$

The current yield and the coupon rate are incomplete calculations for a bond's yield because they do not account for the time value of money, maturity value, or payment frequency.

- Yield to Maturity

A bond's yield to maturity (YTM) is equal to the interest rate that makes the present value of all a bond's future cash flows equal to its current price. These cash flows include all the coupon payments and its maturity value. Solving for YTM is a trial and error process that can be done on a financial calculator, but the formula is as follows:

$$Price = \sum_{t-1}^{T} \frac{CashFlows_t}{(1 + YTM)^t}$$

Where: YTM = Yield to maturity

- Bond Equivalent Yield – BEY

Bond yields are normally quoted as a bond equivalent yield (BEY), which makes an adjustment for the fact that most bonds pay their annual coupon in two semi-annual payments.

The BEY is a simple annualized version of the semi-annual YTM and is calculated by multiplying the YTM by two. The BEY does not account for the time value of money for the adjustment from a semi-annual YTM to an annual rate.

Effective Annual Yield – EAY

Investors can find a more precise annual yield once they know the BEY for a bond if they account for the time value of money in the calculation. In the case of a semi-annual coupon payment, the effective annual yield (EAY) would be calculated as follows:

$$EAY = \left(1 + \frac{YTM}{2}\right)^2 - 1$$

Where:

EAY=Effective Annual Yield

- Complications Finding a Bond's Yield

There are a few factors that can make finding a bond's yield more complicated. For instance, in the previous examples, it was assumed that the bond had exactly five years left to maturity when it was sold, which would rarely be the case.

When calculating a bond's yield, the fractional periods can be dealt with simply; the accrued interest is more difficult. For example, imagine a bond that has four years and eight months left to maturity. The exponent in the yield calculations can be turned into a decimal to adjust for the partial year. However, this means that four months in the current coupon period have elapsed and there are two more to go, which requires an adjustment for accrued interest. A new bond buyer will be paid the full coupon, so the bond's price will be inflated slightly to compensate the seller for the four months in the current coupon period that have elapsed.

Bonds can be quoted with a "clean price" that excludes the accrued interest or the "dirty price" that includes the amount owed to reconcile the accrued interest. When bonds are quoted in a system like a Bloomberg or Reuters terminal, the clean price is used.

What does a bond's yield tell investors?

A bond's yield is the return to an investor from the bond's coupon (interest) payments. It can be calculated as a simple coupon yield, which ignores the time value of money and any changes in the bond's price or using a more complex method like yield to maturity. Higher yields mean that bond investors are owed larger interest payments, but may also be a sign of greater risk. The riskier a borrower is, the more yield investors demand to hold their debts. Higher yields are also associated with longer maturity bonds.

Are high-yield bonds better investments than low-yield bonds?

Like any investment, it depends on one's individual circumstances, goals, and risk tolerance. Low-yield bonds may be better for investors who want a virtually risk-free asset, or one who is hedging a mixed portfolio by keeping a portion of it in a low-risk asset. High-yield bonds may instead be better-suited for investors who are willing to accept a degree of risk in return for a higher return. The risk is that the company or government issuing the bond will default on its debts. Diversification can help lower portfolio risk while boosting expected returns.

What are some common yield calculations?

The yield to maturity (YTM) is the total return anticipated on a bond if the bond is held until it matures. Yield to maturity is considered a long-term bond yield but is expressed as an annual rate. YTM is usually quoted as a bond equivalent yield (BEY), which makes bonds with coupon payment periods less than a year easy to compare. The annual percentage yield (APY) is the real rate of return earned on a savings deposit or investment taking into account the effect of compounding interest. The annual percentage rate (APR) includes any fees or additional costs associated with the transaction, but it does not take into account the compounding of interest within a specific year. An investor in a callable bond also wants to estimate the yield to call (YTC), or the total return that will be received if the bond purchased is held only until its call dateinstead of full maturity.

How do investors utilize bond yields?

In addition to evaluating the expected cash flows from individual bonds, yields are used for more sophisticated analyses. Traders may buy and sell bonds of different maturities to take advantage of the yield curve, which plots the interest rates of bonds having equal credit quality but differing maturity dates. The slope of the yield curve gives an idea of future interest rate changes and economic activity. They may also look to the difference in interest rates between different categories of bonds, holding some characteristics constant. A yield spread is the difference between yields on differing debt instruments of varying maturities, credit ratings, issuer, or risk level, calculated by deducting the yield of one instrument from the other -- for example the spread between AAA corporate bonds and

U.S. Treasuries. This difference is most often expressed in basis points (bps) or percentage points.

Yield to Maturity (YTM)

Yield to maturity (YTM) is the total return anticipated on a bond if the bond is held until it matures. Yield to maturity is considered a long-term bond yield but is expressed as an annual rate. In other words, it is the internal rate of return (IRR) of an investment in a bond if the investor holds the bond until maturity, with all payments made as scheduled and reinvested at the same rate.

Yield to maturity is also referred to as "book yield" or "redemption yield."

Yield to maturity (YTM) is the total rate of return that will have been earned by a bond when it makes all interest payments and repays the original principal.

YTM is essentially a bond's internal rate of return (IRR) if held to maturity.

Calculating the yield to maturity can be a complicated process, and it assumes all coupon or interest, payments can be reinvested at the same rate of return as the bond.

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Bond Yields: Current Yield And YTM

Understanding Yield to Maturity (YTM)

Yield to maturity is similar to current yield, which divides annual cash inflows from a bond by the market price of that bond to determine how much money one would make by buying a bond and holding it for one year. Yet, unlike current yield, YTM accounts for the present value of a bond's future coupon payments. In other words, it factors in the time value of money, whereas a simple current yield calculation does not. As such, it is often considered a more thorough means of calculating the return from a bond.

The YTM of a discount bond that does not pay a coupon is a good starting place in order to understand some of the more complex issues with coupon bonds.

Calculating YTM

The formula to calculate YTM of a discount bond is as follows:

$$YTM = \sqrt[n]{\frac{Face\ Value}{Current\ Price}} - 1$$

Where:

n = Number of years to maturity

Face value = bond’s maturity value or par value

Current price = the bond’s price today

Because YTM is the interest rate an investor would earn by reinvesting every coupon payment from the bond at a constant interest rate until the bond's maturity date, the present value of all the future cash flows equals the bond's market price. An investor knows the current bond price, its coupon payments, and its maturity value, but the discount rate cannot be calculated directly. However, there is a trial-and-error method for finding YTM with the following present value formula:

$$\ldots = \left(\quad \times \frac{1 - \frac{1}{(1+YTM)^{n}}}{YTM} \right) + \left(F \quad \times \frac{1}{(1+YTM)^{n}} \right)$$

Each one of the future cash flows of the bond is known and because the bond's current price is also known, a trial-and-error process can be applied to the YTM variable in the equation until the present value of the stream of payments equals the bond's price.

Solving the equation by hand requires an understanding of the relationship between a bond's price and its yield, as well as the different types of bond pricings. Bonds can be priced at a discount, at par, or at a premium. When the bond is priced at par, the bond's interest rate is equal to its coupon rate. A bond priced above par, called a premium bond, has a coupon rate higher than the realized interest rate, and a bond priced below par, called a discount bond, has a coupon rate lower than the realized interest rate.

If an investor were calculating YTM on a bond priced below par, they would solve the equation by plugging in various annual interest rates that were higher than the coupon rate until finding a bond price close to the price of the bond in question.

Calculations of yield to maturity (YTM) assume that all coupon payments are reinvested at the same rate as the bond's current yield and take into account the bond's current market price, par value, coupon interest rate, and term to maturity. The YTM is merely a snapshot of the return on a bond because coupon payments cannot always be reinvested at the same interest rate. As interest rates rise, the YTM will increase; as interest rates fall, the YTM will decrease.

The complex process of determining yield to maturity means it is often difficult to calculate a precise YTM value. Instead, one can approximate YTM by using a bond yield table, financial calculator, or online yield to maturity calculator.

- Uses of Yield to Maturity (YTM)

Yield to maturity can be quite useful for estimating whether buying a bond is a good investment. An investor will determine a required yield (the return on a bond that will make the bond worthwhile). Once an investor has determined the YTM of a bond they are considering buying, the investor can compare the YTM with the required yield to determine if the bond is a good buy.

Because YTM is expressed as an annual rate regardless of the bond's term to maturity, it can be used to compare bonds that have different maturities and coupons since YTM expresses the value of different bonds in the same annual terms.

- Variations of Yield to Maturity (YTM)

Yield to maturity has a few common variations that account for bonds that have embedded options:

Yield to call (YTC) assumes that the bond will be called. That is, a bond is repurchased by the issuer before it reaches maturity and thus has a shorter cash flow period. YTC is calculated with the assumption that the bond will be called at soon as it is possible and financially feasible.

Yield to put (YTP) is similar to YTC, except the holder of a put bond can choose to sell the bond back to the issuer at a fixed price based on the terms of the bond. YTP is calculated based on the assumption that the bond will be put back to the issuer as soon as it is possible and financially feasible.

Yield to worst (YTW) is a calculation used when a bond has multiple options. For example, if an investor was evaluating a bond with both calls and put provisions, they would calculate the YTW based on the option terms that give the lowest yield.

Limitations of Yield to Maturity (YTM)

YTM calculations usually do not account for taxes that an investor pays on the bond.1 In this case, YTM is known as the gross redemption yield. YTM calculations also do not account for purchasing or selling costs.

YTM also makes assumptions about the future that cannot be known in advance. An investor may not be able to reinvest all coupons, the bond may not be held to maturity, and the bond issuer may default on the bond.

- Yield to Maturity (YTM)

A bond's yield to maturity (YTM) is the internal rate of return required for the present value of all the future cash flows of the bond (face value and coupon payments) to equal the current bond price. YTM assumes that all coupon payments are reinvested at a yield equal to the YTM and that the bond is held to maturity.

Some of the more known bond investments include municipal, treasury, corporate, and foreign. While municipal, treasury, and foreign bonds are typically acquired through local, state, or federal governments, corporate bonds are purchased through brokerages.2 If you have an interest in corporate bonds then you will need a brokerage account.

- What Is a Bond's Yield to Maturity (YTM)?

The YTM of a bond is essentially the internal rate of return (IRR) associated with buying that bond and holding it until its maturity date. In other words, it is the return on investment associated with buying the bond and reinvesting its coupon payments at a constant interest rate. All else being equal, the YTM of a bond will be higher if the price paid for the bond is lower, and vice-versa.

- What Is the Difference Between a Bond's YTM and Its Coupon Rate?

The main difference between the YTM of a bond and its coupon rate is that the coupon rate is fixed whereas the YTM fluctuates over time. The coupon rate is contractually fixed, whereas the YTM changes based on the price paid for the bond as well as the interest rates available elsewhere in the marketplace. If the YTM is higher than the coupon rate, this suggests that the bond is being sold at a discount to its par value. If, on the other hand, the YTM is lower than the coupon rate, then the bond is being sold at a premium.

- Is It Better to Have a Higher YTM?

Whether or not a higher YTM is positive depends on the specific circumstances. On the one hand, a higher YTM might indicate that a bargain opportunity is available since the bond in question is available for less than its par value. But the key question is whether or not this discount is justified by fundamentals such as the creditworthiness of the company issuing the bond, or the interest rates presented by alternative investments. As is often the case in investing, further due diligence would be required.

2.3. Equity Valuation

Equity valuation is a blanket term and is used to refer to all tools and techniques used by investors to find out the true value of a company's equity. It is often seen as the most crucial element of a successful investment decision. Investment Banks typically have a equity research department, where research analysts produce equity research reports of select securities in various industries.

Every participant in the stock market either implicitly or explicitly makes use of equity valuation while making investment decisions. Everyone from small individual investors to large institutional investors use equity valuations to make investment decisions in equity markets. The total size of the global equity market is estimated to be around $70 trillion and every participant in the stock market, from professional fund managers to academic researchers, is trying to find mispriced stocks.

Inputs in the Equity Valuation Process

The true value of any financial asset is thought to be a good indicator of how that asset will do in the long run. In equity markets, a financial asset with a relatively high intrinsic value is expected to command a high price, and a financial asset with a relatively low intrinsic value is expected to command a low price.

Distortions can take place in the short run, i.e., financial assets with relatively low intrinsic value might command a high price and vice-a-versa, but such distortions are expected to disappear over time. In the long run, the true value of a stock (and thereby the market price of that stock) depends only on the fundamental factors affecting the stock. The factors can be broadly classified into four categories.

- Macroeconomic variables
- Management of the business
- Financial health of the business
- Profits of the business

2.4. Dividend Discount Model

The Dividend Discount Model (DDM) is a quantitative method of valuing a company's stock price based on the assumption that the current fair price of a stock equals the sum of all of the company's future dividends discounted back to their present value.

The dividend discount model was developed under the assumption that the intrinsic value of a stock reflects the present value of all future cash flows generated by a security. At the same time, dividends are essentially the positive cash flows generated by a company and distributed to the shareholders.

Generally, the dividend discount model provides an easy way to calculate a fair stock price from a mathematical perspective with minimum input variables required. However, the model relies on several assumptions that cannot be easily forecasted.

Depending on the variation of the dividend discount model, an analyst requires forecasting future dividend payments, the growth of dividend payments, and the cost of equity capital. Forecasting all the variables precisely is almost impossible. Thus, in many cases, the theoretical fair stock price is far from reality.

Formula for the Dividend Discount Model

The dividend discount model can take several variations depending on the stated assumptions. The variations include the following:

1. Gordon Growth Model

The Gordon Growth Model (GGM) is one of the most commonly used variations of the dividend discount model. The model is called after American economist Myron J. Gordon, who proposed the variation. The GGM assists an investor in evaluating a stock's intrinsic value based on the potential dividend's constant rate of growth.

The GGM is based on the assumption that the stream of future dividends will grow at some constant rate in the future for an infinite time. The model is helpful in assessing the value of stable businesses with strong cash flow and steady levels of dividend growth. It generally assumes that the company being evaluated possesses a constant and stable business model and that the growth of the company occurs at a constant rate over time.

Mathematically, the model is expressed in the following way:

$$V_0 = \frac{D_1}{r - g}$$

Where:

V0 – The current fair value of a stock

D1 – The dividend payment in one period from now

r – The estimated cost of equity capital (usually calculated using CAPM) g – The constant growth rate of the company's dividends for an infinite time

2. One-Period Dividend Discount Model

The one-period discount dividend model is used much less frequently than the Gordon Growth model. The former is applied when an investor wants to determine the intrinsic price of a stock that he or she will sell in one period (usually one year) from now.

The one-period DDM generally assumes that an investor is prepared to hold the stock for only one year. Because of the short holding period, the cash flows expected to be generated by the stock are the single dividend payment and the selling price of the respective stock.

Hence, to determine the fair price of the stock, the sum of the future dividend payment and that of the estimated selling price, must be computed and discounted back to their present values.

The one-period dividend discount model uses the following equation:

$$V_0 = \frac{D_1}{1+r} + \frac{P_1}{1+r}$$

Where:

V0 – The current fair value of a stock

D1 – The dividend payment in one period from now

P1 – The stock price in one period from now

r – The estimated cost of equity capital

3. Multi-Period Dividend Discount Model

The multi-period dividend discount model is an extension of the one-period dividend discount model wherein an investor expects to hold a stock for multiple periods. The main challenge of the multi-period model variation is that forecasting dividend payments for different periods is required.

In the multiple-period DDM, an investor expects to hold the stock he or she purchased for multiple time periods. Therefore, the expected future cash flows will consist of numerous dividend payments, and the estimated selling price of the stock at the end of the holding period.

The intrinsic value of a stock (via the Multiple-Period DDM) is found by estimating the sum value of the expected dividend payments and the selling price, discounted to find their present values.

The model's mathematical formula is below:

$$V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \cdots + \frac{D_n}{(1+r)^n} + \frac{P_n}{(1+r)^n}$$

Shortcomings of Dividend Discount Model

A shortcoming of the DDM is that the model follows a perpetual constant dividend growth rate assumption. This assumption is not ideal for companies with fluctuating dividend growth rates or irregular dividend payments, as it increases the chances of imprecision.

Another drawback is the sensitivity of the outputs to the inputs. Furthermore, the model is not fit for companies with rates of return that are lower than the dividend growth rate.

2.5. The P/E Ratio Approach

The Price Earnings Ratio (P/E Ratio) is the relationship between a company's stock price and earnings per share (EPS). EPS is a financial ratio, which divides net earnings available to common shareholders by the average outstanding shares over a certain period of time. The EPS formula indicates a company's ability to produce net profits for common shareholders. This guide breaks down the Earnings per Share formula in detail. It is a popular ratio that gives investors a better sense of the value of the company. The P/E ratio shows the expectations of the market and is the price you must pay per unit of current earnings (or future earnings, as the case may be).

Earnings are important when valuing a company's stock because investors want to know how profitable a company is and how profitable it will be in the future. Furthermore, if the company doesn't grow and the current level of earnings remains constant, the P/E can be interpreted as the number of years it will take for the company to pay back the amount paid for each share.

The P/E ratio is standardizes stocks of different prices and earnings levels. The P/E is also called an earnings multiple. There are two types of P/E: trailing and forward. The former is based on previous periods of earnings per share, while a leading or forward P/E ratio is when EPS calculations are based on future estimates, which predicted numbers (often provided by management or equity research analysts).

Price Earnings Ratio Formula

P/E = Stock Price Per Share / Earnings Per Share   or

P/E = Market Capitalization / Total Net Earnings   or

Justified P/E = Dividend Payout Ratio / R – G

where;

R = Required Rate of Return

G = Sustainable Growth Rate

The basic P/E formula takes the current stock price and EPS to find the current P/E. EPS is found by taking earnings from the last twelve months divided by the weighted average shares outstanding. Earnings can be normalized for unusual or one-off items that can impact earnings abnormally. Learn more about normalized EPS.

The justified P/E ratio is used to find the P/E ratio that an investor should be paying for, based on the companies dividend and retention policy, growth rate, and the investor's required rate of return. Comparing justified P/E to basic P/E is a common stock valuation method.

Investors want to buy financially sound companies that offer a good return on investment (ROI). Among the many ratios, the P/E is part of the research process for selecting stocks because we can figure out whether we are paying a fair price. Similar companies within the same industry are grouped together for comparison, regardless of the varying stock prices. Moreover, it's quick and easy to use when we're trying to value a company using earnings. When a high or a low P/E is found, we can quickly assess what kind of stock or company we are dealing with.

2.6. Modigliani – Miller Theorem

The M&M Theorem, or the Modigliani-Miller Theorem, is one of the most important theorems in corporate finance. The theorem was developed by economists Franco Modigliani and Merton Miller in 1958. This theorem also known as 'Capital Structure Irrelevance Theorem'. The main idea of the M&M theory is that the capital structure of a company does not affect its overall value.

The first version of the M&M theory was full of limitations as it was developed under the assumption of perfectly efficient markets, in which the companies do not pay taxes, while there are no bankruptcy costs or asymmetric information. Subsequently, Miller and Modigliani developed the second version of their theory by including taxes, bankruptcy costs, and asymmetric information.

The M&M Theorem in Perfectly Efficient Markets

This is the first version of the M&M Theorem with the assumption of perfectly efficient markets. The assumption implies that companies operating in the world of perfectly efficient markets do not pay any taxes, the trading of securities is executed without any transaction costs, bankruptcy is possible but there are no bankruptcy costs, and information is perfectly symmetrical.

Proposition 1 (M&M I): $V_L = V_U$

Where:

VU = Value of the unlevered firm (financing only through equity)

VL = Value of the levered firm (financing through a mix of debt and equity)

The first proposition essentially claims that the company's capital structure does not impact its value. Since the value of a company is calculated as the present value of future cash flows, the capital structure cannot affect it. Also, in perfectly efficient markets, companies do not pay any taxes. Therefore, the company with a 100% leveraged capital structure does not obtain any benefits from tax-deductible interest payments.

Proposition 2 (M&M I):

$$r_E = r_a + \frac{D}{E}(r_a - r_D)$$

Where:

r_E = Cost of levered equity

r_a = Cost of unlevered equity

r_D = Cost of debt

D/E = Debt-to-equity ratio

The second proposition of the M&M Theorem states that the company's cost of equity is directly proportional to the company's leverage level. (Cost of Equity is the rate of return a company pays out to equity investors. A firm uses cost of equity to assess the relative attractiveness of investments, including both internal projects and external acquisition opportunities. Companies typically use a combination of equity and debt financing, with equity capital being more expensive.) An increase in leverage level induces higher default probability to a company. Therefore, investors tend to demand a higher cost of equity (return) to be compensated for the additional risk.

M&M Theorem in the Real World

Conversely, the second version of the M&M Theorem was developed to better suit real-world conditions. The assumptions of the newer version imply that companies pay taxes; there are transaction, bankruptcy, and agency costs; and information is not symmetrical.

The first proposition states that tax shields that result from the tax-deductible interest payments make the value of a levered company higher than the value of an unlevered company. The main rationale behind the theorem is that tax-deductible interest payments positively affect a company's cash flows. Since a company's value is determined as the present value of the future cash flows, the value of a levered company increases.

Proposition 2 (M&M II):

$$r_E = r_a + \frac{D}{E} \times (1 - t_c) \times (r_a - r_D)$$

The second proposition for the real-world condition states that the cost of equity has a directly proportional relationship with the leverage level.

Nonetheless, the presence of tax shields affects the relationship by making the cost of equity less sensitive to the leverage level. Although the extra debt still increases the chance of a company's default, investors are less prone to negatively reacting to the company taking additional leverage, as it creates the tax shields that boost its value.

Module III

Risk and Return

Certainty is a situation where in the value the variable can take is known with a probability of unity. In a situation of uncertainty, the objective probability distribution of values is not known, but the experts can have a feel about the range of values a variable can take along with the chances of their occurrence. These subjective feelings can be translated into subjective probabilities and can be used when objective probabilities are not available.

Risk is a situation where in the objective probability distribution of the values a variable can take is known, even though the exact values it would take are not known. The objective probability is one which is supported by rigorous theory, past experience and the laws of chance. Strictly speaking, while the risk is measurable, uncertainty is not. Since a situation of uncertainty can be reduced to a situation of risk by using subjective probabilities, the two terms, risk and uncertainty, are generally used interchangeably. In a practically useful way, the risk can be defined as the chance that the expected or prospective advantage, gain, profit or return may not materialise and that the actual outcome of investment may be less than the expected outcome.

3.1. Types of Risk

Systematic versus Unsystematic Risk

The different types of risks are broadly classified as systematic and unsystematic risks. The variability in a security's total return that is directly associated with the overall movements in the general market or economy is called systematic risk. This type of risk is inescapable no matter how well the portfolio is diversified. It is caused by a wide range of factors exogenous to securities themselves, viz., recession, war and structural changes in the economy. The other names for systematic risk are market risk or non-diversifiable risk: it would be more appropriate to call it a 'systemic' risk. The systematic risk arises due to the fluctuations of the macroeconomic fundamentals such as interest rate, inflation and so on.

The variability in a security's total return that is not related to the overall market variability is called unsystematic risk. An investor can build a diversified portfolio and reduce or eliminate this type of risk. Therefore, it has also been defined as that risk which can be reduced or eliminated through diversification of security holdings. The other names for unsystematic risk are 'non-market risk' or 'diversifiable risk'; it would be more appropriate to call it a 'non-systemic' risk. The unsystematic risk can also be called as idiosyncratic risk, which is specific to the company or any individual.

Market Risk (Beta)

The capital market and portfolio theories have developed a 'critically important concept of beta (β) measure of relative risk of a security or its sensitivity to the movements in the market. Beta indicate extent to which the risk of a given asset is non-diversifiable; it is a coefficient measuring a security's relative volatility, Statistically, beta is the covariance of a security's return with that of the market for a security Alternatively, it is the slope of the regression line relating a security return with the market return. The security with a higher (than 1) beta is more volatile than the market, and the asset with a lower (than 1) beta would rise or fall more slowly than the market.

Figure.3.1 Concept of Beta

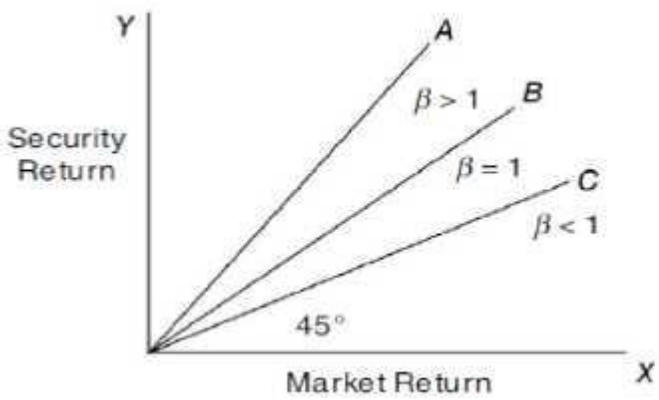


Figure 3.1 portrays the concept of beta. Line β (45 degree line) represents β= 1 which means that for every one percentage change in the market return, on an average, the security return also will change by 1 percent, that is, both the returns will be volatile to the same extent. Line A means that the security return is more volatile than the market return, while, line C means that the former is less volatile than the latter.

Interest Rate Risk

Interest rate risk is the variability in return on security due to changes in the level of market interest rates, or it is the loss of principal of a fixed-return security due to an increase in the general level of interest rates. When interest rates rise, the value or market price of the security drops, and vice versa. The degree of interest rate risk is directly related to the length of time to maturity of the security, if the term to maturity is long. market value of the security may fluctuate widely.

Interest rate risk has two parts; first, the price risk resulting from the inverse relationship between the security price and interest rates, and second, the reinvestment risk resulting from the uncertainty about the interest rate at which the future coupon income or principal can be reinvested. These two parts of interest rate risk move in opposite directions. If interest rates increase, the price risk increases (because the security price declines) but the reinvestment risk declines (because the reinvestment rate increases). Interest rate risk exists in case of all types of securities including common stock, although it affects bonds more directly than equities.

Inflation Risk

Inflation risk is the risk that the real return on a security may be less than the nominal return. In case of fixed income securities, since payments in terms of rupees are fixed, the value of the payments in real terms declines as the level of commodity prices increases. Inflation risk is also known as purchasing power risk as there is always a chance or possibility that the purchasing power of invested money will decline, or that the real (inflation-adjusted) return will decline due to inflation. It may be noted that inflation risk is really the risk of unanticipated or uncertain inflation. If anticipated, inflation can be compensated. Similarly, inflation risk, like default risk, is more relevant in case of fixed income securities; common stocks are regarded as hedges against inflation. Inflation risk is closely related to interest rate risk since interest rates generally rise when inflation occurs.

Exchange Rate or Currency Risk

Exchange rate risk refers to cash-flow variability experienced by economic units engaged in international transactions or international exchange, on account of uncertain or unexpected changes in exchange rates. It is the risk that changes in currency exchange rates may have an unfavourable impact on costs or revenues of, say, business units. There is no exchange rate risk under the fixed exchange rate system, while it is the highest under the freely floating exchange rate system.

Business Risk

Business risk is the uncertainty of income flows that is caused by the nature of a firm's business, that is, by doing business in a particular environment. This risk has two components: internal and external. The former results from the operating conditions or operating efficiency of the firm, and it is manageable within or by the firm. The latter is the result of operating conditions which the firm faces but which are beyond its control. Business risk is measured by the distribution of the firm's operating income (i.e. firm's earnings before interest and tax) over time.

Financial Risk

Financial risk is associated with the use of debt financing by firms or companies. Since the presence of debt involves the legal or mandatory obligation make specified payments at specified time periods, there is a risk that the earnings of the firm may not be sufficient to meet these obligations towards the creditors. In case of shareholders, the financial risk arises because of not only the mandatory nature of debt obligations but also the property of prior payments of these obligations. In short, the use of debt by the firm causes variability of return for both creditors and shareholders. Financial risk is usually measured by the debt equity ratio of the firm; the higher this ratio, the greater the variability of return and higher the financial risk

Default Risk

Default risk arises from the failure on the part of the borrower or debtor to pay the specified amount of interest and/or to repay the principal, both at the time specified in the debt contractor covenant or indenture. It may be noted that the default risk has the capital risk and income risk as its components, and that it means not only the complete failure to pay but also the delay in payment.

Liquidity Risk

Liquidity risk refers to a situation wherein it may not be possible to dispose off or sell the asset, or it may be possible to do so only at great inconvenience and cost in terms of money and time. An asset that can be bought and sold quickly, and without significant price concession and transaction cost is said to be liquid. The greater the uncertainty about time element, price concession and transaction cost, the greater the liquidity risk. Liquidity risk refers to their inability to meet the liabilities towards depositors when they want to withdraw their deposits.

Maturity Risk

Maturity risk arises when the term of maturity of the security happens to be longer. Since foreseeing, forecasting and envisioning the environment, conditions and situations become more and more difficult as we stretch more and more into the future, the long-term investment involves risk. The longer the term to maturity, the greater is the risk.

Call Risk

Call risk is associated with the corporate bonds which are issued with call-back provision or option whereby the issuer has the right of redeeming the bonds before their maturity. In case of such bonds, the band holders face the risk of giving up higher coupon bonds, reinvesting proceeds only at lower interest rates, and incurring the cost and inconvenience of reinvestment.

Total Risk

Total risk is the total variability in the return on the asset or the portfolio, whatever the source(s) of that variability. It is the uncertainty or volatility in return due to both security-specific and economy-wide factors. We can say that total risk is the summation of the systematic and unsystematic risk.

Country Risk

The uncertainty or variability of return in respect of an investment in a foreign country is known as country risk. It is a complicated concept and it has many elements or sources. The political risk is one of its major elements, and the common denominator of political risk is the government intervention in the working of the economy that affects the value of the firm or investment. Economic stability is its another important element.

3.2. Historical returns and Risk

Historical (Ex-Post) Returns

Historical returns are often associated with the past performance of a security or index, such as the S&P 500. Investors study historical return data when trying to forecast future returns or to estimate how a security might react in a situation. Calculating the historical return is done by subtracting the most recent price from the oldest price and divide the result by the oldest price.

The return is the total gain or loss experienced on an investment over a given period of time. It is commonly measured as cash distributions during the period plus the change in value, expressed as a percentage of the beginning-of-period investment value. For stocks, the return for a particular time period is equal to the sum of the price change plus dividends received, divided by the price at the beginning of the time period. Assuming there are many stocks, we can have the general measure of returns for the i^{th} stock, for the time period t-1 to t:

$$R_{it} = \frac{(P_{it} - P_{i,t-1}) + D_i}{P_{i,t-1}}$$

Suppose we are concerned only with the i^{th} stock and are interested in obtaining a measure of historical performance of his stock, that is a measure of average returns on this stock over the time period t = 1, 2, …, T. We get is straightforward arithmetic mean:

$$R_i = \frac{1}{T}(R_{i1} + R_{i2} + R_{i3} + \cdots R_{iT}$$

This can be written more compactly as:

$$R_i = \frac{1}{T}\sum_{t=1}^{T} R_{it}$$

Of course, other than finding out the average returns over time for a single stock, we can as well obtain the average returns for several stock for a single time period. The method is the same, except that we aggregate over the number of shares rather than number of time periods. Let there be n shares: i = 1,2,3,…,n. Then

Historical (Ex-Post) Risk

In investment analysis, basically risk is associated with variability of rates of return. Variability is usually measured as individual returns in relation to the average. In statistics, one of the basic measures of variability is the variance. The positive square root of the variance is the standard deviation, usually denoted by the lower-case Greek letter sigma (σ) .The variance (square of standard deviation) is defined as:

$$\sigma^2 = \frac{1}{T-1}\sum_{t=1}^{T}(R_{it} - R_i)^2$$

Thus the variance can be considered as the average square deviation from the mean return. To calculate the variance, we first calculate the mean return. Then the difference between the return for each period and the mean return is obtained. These deviations from the mean are squared and added together. This sum is divided by T – 1 (the total number of time periods minus one).

The standard deviation is the positive square root of the variance:

$$\sigma = +\sqrt{\sigma^2}$$

3.3. Average Annual Returns

The average annual return (AAR) is a percentage used when reporting the historical return, such as the three-, five-, and 10-year average returns of an asset. The average annual return is stated net of a fund's operating expense ratio. Additionally, it does not include sales charges, if applicable, or portfolio transaction brokerage commissions. The three components that contribute to the average annual return of a fund are share price appreciation, capital gains, and dividends. Average annual return (AAR) measures the money made or lost by a fund over a given period. Investors considering any investment will often review the AAR and compare it with other similar funds as part of their investment strategy.

Components of an Average Annual Return (AAR)

There are three components that contribute to the average annual return (AAR) of any financial asset: share price appreciation, capital gains, and dividends.

- Share Price Appreciation

Share price appreciation results from unrealized gains or losses in the underlying stocks held in a portfolio. As the share price of a stock fluctuates over a year, it proportionately contributes to or detracts from the AAR of the fund that maintains a holding in the issue.

- Capital Gains Distributions

Capital gains distributions paid from a mutual fund result from the generation of income or sale of stocks from which a manager realizes a profit in a growth portfolio. Shareholders can opt to receive the distributions in cash or reinvest them in the fund. Capital gains are the realized portion of AAR. The distribution, which reduces share price by the dollar amount paid out, represents a taxable gain for shareholders.

- Dividends

A dividend is the distribution of some of a company's earnings to a class of its shareholders, as determined by the company's board of directors. Common shareholders of dividend-paying companies are typically eligible as long as they own the stock before the ex-dividend date. Dividends may be paid out as cash or in the form of additional stock. Dividend income received from the portfolio can be reinvested or taken in cash.

Risk and Return of a Portfolio

Here we set out the basics of risk and return associated with a portfolio of assets. This type of analysis was pioneered by Harry Markowitz. Markowitz observed that investors do not always try to maximize returns. If they wanted to do so, they would simply hold only that security which they expected would give the highest returns. Thus investors are concerned both with return and risk, and since they hold a portfolio of assets, it showed that diversification can lower risk without adversely affecting returns.

The return for a portfolio is simply a weighted average of the returns of the securities in the portfolio. For a single time period t, the portfolio return is calculated as:

$$R_{pt} = \sum_{i=1}^{n} R_{it} W_{it}$$

Where, W_{it} is the market value of the i^{th} asset divided by the market value of the entire portfolio.

The variance of a portfolio is a little complicated because we also have to consider any two assets of a portfolio together. The general formula for variance of a portfolio is

Where Cov_{ij} represents the covariance between any two assets I and j. We can calculate the correlation coefficient :

$$p_{ij} = \frac{Cov_{ij}}{\sigma_i \sigma_j}$$

The correlation coefficient always lies between –1 and +1 and is a measure of the strength of the linear association between assets i and j. A value of –1 or +1 shows perfect linear relation (the former an inverse relation) while a value of 0 shows no relationship.

Determinants of Beta

The capital market and portfolio theories have developed a 'critically important concept of beta (β) measure of relative risk of a security or its sensitivity to the movements in the market. Beta indicate extent to which the risk of a given asset is non-diversifiable; it is a coefficient measuring a security's relative volatility, Statistically, beta is the covariance of a security's return with that of the market for a security Alternatively, it is the slope of the regression line relating a security return with the market return. The security with a higher (than 1) beta is more volatile than the market, and the asset with a lower (than 1) beta would rise or fall more slowly than the market.

Beta is calculated as the covariance between returns on the asset and returns on the market portfolio divided by the variance of returns on the market portfolio. Or, it is typically found by regressing stock or portfolio return on a proxy for market return.

It measures the volatility of the portfolio related to the stock market index like the BSE Sensex.

Figure.3.1 Concept of Beta

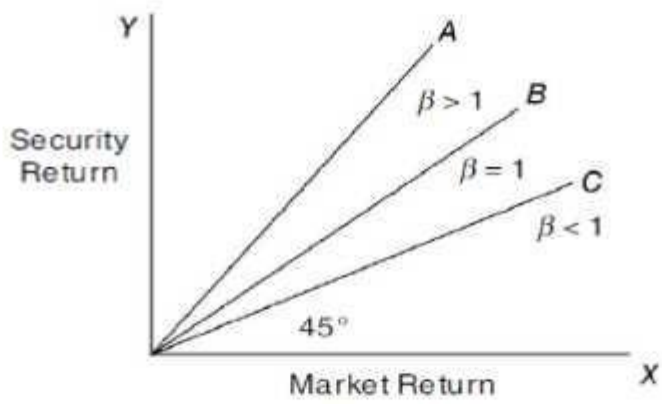


Figure 3.1 portrays the concept of beta. Line β (45 degree line) represents β= 1 which means that for every one percentage change in the market return, on an average, the security return also will change by 1 percent, that is, both the returns will be volatile to the same extent. Line A means that the security return is more volatile than the market return, while, line C means that the former is less volatile than the latter.

Beta Coefficient or Factor: It is a measure of performance of a particular share or class of shares in relation to the general movement of the market in terms of the price of respective shares. It indicates systematic risk of investment in a share. It is calculated as the covariance between returns on the asset and returns on the market portfolio divided by the variance of the returns

Risk Return Trade off

The objective of maximizing return can be pursued only at the cost of incurring higher risk. The financial markets offer a wide range of assets from very safe to very risky with corresponding low to high returns. While selecting the asset for investment, the investor has to consider both its return potential and the risk involved. The empirical evidence shows that generally there is a high correlation between risk and return over longer periods of time. The securities are generally priced such that high risk is rewarded with high return, and low risk is accompanied by return. This relationship is known as risk-return trade-off.

Figures and portray risk-return trade-off in an ex ante sense. In Figure 2.2, the line AB (capital market line) depicts the expected return-risk spectrum; the representative asset classes are arrayed over risk on it. As we move from government bonds to international equity, the investor assumes increasing risk in the hope of earning a higher expected return. AB is upward sloping and its slope indicates the required return per unit of risk. The figure shows a positive linear relationship between expected return and risk. The rational risk-averse investors will not willingly assume greater risk unless they expect to receive additional return, or if the investors wish to earn larger return, they must be willing to assume greater risk.

Trade-off

Figure: Risk Return Trade off

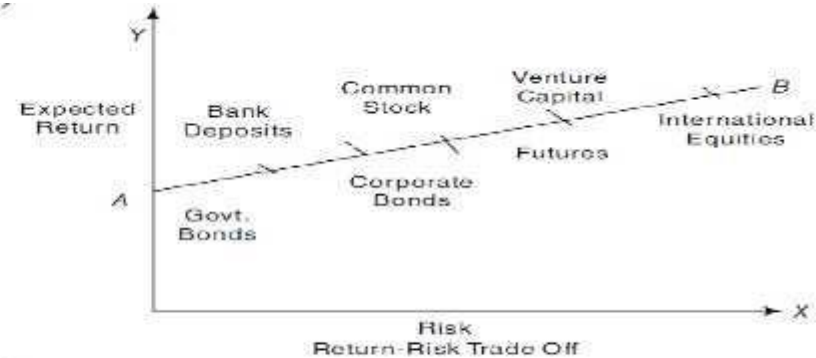
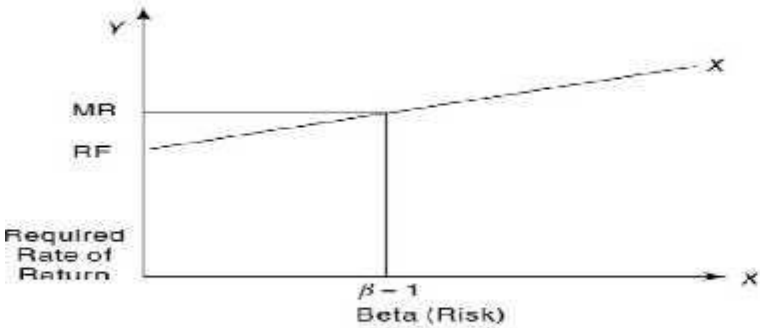


Figure 2.3 shows the same relationship slightly differently; it relates RRR with beta (risk). It shows that the relationship between them, represented by the line RFX (security market line) is linear. The securities with high beta have high RRR. The securities with betas (risk) greater than the market beta of 1 should have large risk premium than that of the average stock, and, therefore, when added to MR, they yield a larger RRR. Conversely, securities with beta less than that of the market are less risky and have RRR lower than that for the market as a whole.

Figure: Required Rate of Return and Beta Trade off



Module IV

Cost of Capital and Capital Asset Pricing Model

4.1. Cost of capital

Cost of capital is a company's calculation of the minimum return that would be necessary in order to justify undertaking a capital budgeting project, such as building a new factory. The term cost of capital is used by analysts and investors, but it is always an evaluation of whether a projected decision can be justified by its cost. Investors may also use the term to refer to an evaluation of an investment's potential return in relation to its cost and its risks. Many companies use a combination of debt and equity to finance business expansion. For such companies, the overall cost of capital is derived from the weighted average cost of all capital sources. This is known as the weighted average cost of capital (WACC).

Cost of capital represents the return a company needs to achieve in order to justify the cost of a capital project, such as purchasing new equipment or constructing a new building. Cost of capital encompasses the cost of both equity and debt, weighted according to the company's preferred or existing capital structure. This is known as the weighted average cost of capital (WACC).

A company's investment decisions for new projects should always generate a return that exceeds the firm's cost of the capital used to finance the project. Otherwise, the project will not generate a return for investors.

The concept of the cost of capital is key information used to determine a project's hurdle rate. A company embarking on a major project must know how much money the project will have to generate in order to offset the cost of undertaking it and then continue to generate profits for the company.

Cost of capital, from the perspective of an investor, is an assessment of the return that can be expected from the acquisition of stock shares or any other investment. This is an estimate and might include best- and worst-case scenarios. An investor might look at the volatility (beta) of a company's financial results to determine whether a stock's cost is justified by its potential return.

Weighted Average Cost of Capital (WACC)

A firm's cost of capital is typically calculated using the weighted average cost of capital formula that considers the cost of both debt and equity capital.

Each category of the firm's capital is weighted proportionately to arrive at a blended rate, and the formula considers every type of debt and equity on the company's balance sheet, including common and preferred stock, bonds, and other forms of debt.

4.2. Cost of Debt

The cost of capital becomes a factor in deciding which financing track to follow: debt, equity, or a combination of the two.

Early-stage companies rarely have sizable assets to pledge as collateral for loans, so equity financing becomes the default mode of funding. Less-established companies with limited operating histories will pay a higher cost for capital than older companies with solid track records since lenders and investors will demand a higher risk premium for the former.

The cost of debt is merely the interest rate paid by the company on its debt. However, since interest expense is tax-deductible, the debt is calculated on an after-tax basis as follows:

$$Cost\ of\ debt = \frac{Interest\ expense}{Total\ debt} \times (1 - T)$$

Where:

Interest expense= initial paid on the firm's current debt

T = The company's marginal tax rate

The cost of debt can also be estimated by adding a credit spread to the risk-free rate and multiplying the result by (1 - T).

4.3. Cost of equity

The cost of equity is more complicated since the rate of return demanded by equity investors is not as clearly defined as it is by lenders. The cost of equity is approximated by the capital asset pricing model as follows:

$$CAPM\ (Cost\ of\ equity) = R_f + \beta(R_m - R_f)$$

Where:

R_f = Risk free rate of return

R_m = market rate of return

Beta is used in the CAPM formula to estimate risk, and the formula would require a public company's own stock beta. For private companies, a beta is estimated based on the average beta among a group of similar public companies. Analysts may refine this beta by calculating it on an after-tax basis. The assumption is that a private firm's beta will become the same as the industry average beta. The firm’s overall cost of capital is based on the weighted average of these costs.

4.4. Cost Preference Capital

The cost of preference capital is a function of the dividend expected by investors. Preference capital is never issued with an intention not to pay dividends. Although it is not legally binding upon the firm to pay dividends on preference capital, yet it is generally paid when the fim1 makes sufficient profits. The failure to pay dividends, although does not cause bankruptcy, yet it can be a serious matter from the common (ordinary) shareholders’ point of view. The nonpayment of dividends on preference capital may result in voting rights and control to the preference shareholders. More than this, the firm’s credit standing may be damaged. The accumulation of preference dividend arrears may adversely affect the prospects of ordinary shareholders for receiving any dividends, because dividends on preference capital represent a prior claim on profits. As a consequence, the fim1 may find difficulty in raising funds by issuing preference or equity shares. Also, the market value of the equity shares can be adversely affected if dividends are not paid to the preference shareholders and, therefore, to the equity shareholders. For these reasons, dividends on preference capital should be paid regularly except when the firm does not make profits, or it is in a very tight cash position.

The measurement of the cost of preference capital poses some conceptual difficulty. In the case of debt, there is a binding legal obligation on the firm to pay interest, and the interest constitutes the basis to calculate the cost of debt. However, in the case of preference capital, payment of dividends is not legally binding on the firm and even if the dividends are paid, it is not a charge on earnings; rather it is a distribution or appropriation of earnings to preference shareholders.

4.5. Capital Market Line (CML)

The Capital Market Line is a graphical representation of all the portfolios that optimally combine risk and return. CML is a theoretical concept that gives optimal combinations of a risk-free asset and the market portfolio. The CML is superior to Efficient Frontier in the sense that it combines the risky assets with the risk-free asset.

- The slope of the Capital Market Line(CML) is the sharp ratio of the market portfolio.
- The efficient frontier represents combinations of risky assets.
- If we draw a line from the risk-free rate of return, which is tangential to the efficient frontier, we get the Capital Market Line. The point of tangency is the most efficient portfolio.
- Moving up the CML will increase the risk of the portfolio, and moving down will decrease the risk. Subsequently, the return expectation will also increase or decrease, respectively.

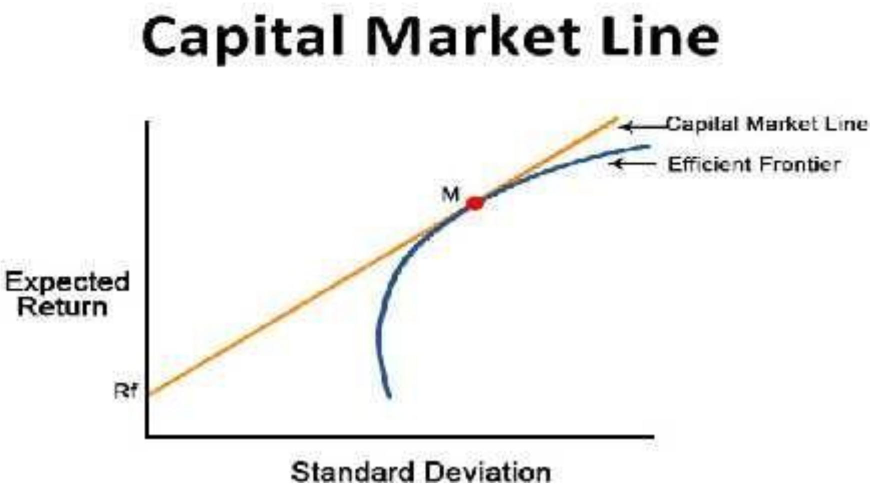
All investors will choose the same market portfolio, given a specific mix of assets and the associated risk with them.

Capital Market Line Formula

The Capital Market Line (CML) formula can be written as follows:

where,

- ER_p= Expected Return of Portfolio
- R_f = Risk – free rate
- SD_p= Standard deviation of Portfolio
- ER_m = Expected Return of the Market
- SD_m = Standard Deviation of Market



Portfolios that fall on the capital market line (CML), in theory, optimize the risk/return relationship, thereby maximizing performance. The capital allocation line (CAL) makes up the allotment of risk-free assets and risky portfolios for an investor. CML is a special case of the CAL where the risk portfolio is the market portfolio. Thus, the slope of the CML is the Sharpe ratio of the market portfolio. As a generalization, buy assets if the Sharpe ratio is above the CML and sell if the Sharpe ratio is below the CML.

As an investor moves up the CML, the overall portfolio risk and returns increase. Risk-averse investors will select portfolios close to the risk-free asset, preferring low variance to higher returns. Less risk-averse investors will prefer portfolios higher up on the CML, with a higher expected return, but more variance. By borrowing funds at the risk-free rate, they can also invest more than 100% of their investable funds in the risky market portfolio, increasing both the expected return and the risk beyond that offered by the market portfolio.

4.6. Security Market Line (SML)

The security market line (SML) is the graphical representation of the Capital Asset Pricing Model (CAPM) and gives the expected return of the market at different levels of systematic or market risk. It is also called 'characteristic line' where the x-axis represents beta or the risk of the assets, and the y-axis represents the expected return.

Also known as the "characteristic line," the SML is a visualization of the CAPM, where the x-axis of the chart represents risk (in terms of beta), and the y-axis of the chart represents expected return. The market risk premium of a given security is determined by where it is plotted on the chart relative to the SML.

The security market line is an investment evaluation tool derived from the CAPM—a model that describes risk-return relationship for securities—and is based on the assumption that investors need to be compensated for both the time value of money (TVM) and the corresponding level of risk associated with any investment, referred to as the risk premium.

The security market line is commonly used by money managers and investors to evaluate an investment product that they're thinking of including in a portfolio. The SML is useful in determining whether the security offers a favorable expected return compared to its level of risk.

When a security is plotted on the SML chart, if it appears above the SML, it is considered undervalued because the position on the chart indicates that the security offers a greater return against its inherent risk.

Conversely, if the security plots below the SML, it is considered overvalued in price because the expected return does not overcome the inherent risk. The SML is frequently used in comparing two similar securities that offer approximately the same return, in order to determine which of them involves the least amount of inherent market risk relative to the expected return. The SML can also be used to compare securities of equal risk to see which one offers the highest expected return against that level of risk.

4.7. Beta of an Asset and of a Portfolio

Beta is a measure of the volatility—or systematic risk—of a security or portfolio compared to the market as a whole. Beta is used in the capital asset pricing model (CAPM), which describes the relationship between systematic risk and expected return for assets (usually stocks). CAPM is widely used as a method for pricing risky securities and for generating estimates of the expected returns of assets, considering both the risk of those assets and the cost of capital.

A beta coefficient can measure the volatility of an individual stock compared to the systematic risk of the entire market. In statistical terms, beta represents the slope of the line through a regression of data points. In finance, each of these data points represents an individual stock's returns against those of the market as a whole.

Beta effectively describes the activity of a security's returns as it responds to swings in the market. A security's beta is calculated by dividing the product of the covariance of the security's returns and the market's returns by the variance of the market's returns over a specified period.

The calculation for beta is as follows:

$$Beta\ Coefficient(\beta) = \frac{Covariance\ (R_e, R_m)}{Variance\ (R_m)}$$

Where:

R_e = the return on an individual stock

R_m the return on the overall market

Covariance = how changes in a stock's returns are related to changes in the market's returns

Variance = how far the market's data points spread out from their average value

The beta calculation is used to help investors understand whether a stock moves in the same direction as the rest of the market. It also provides insights about how volatile–or how risky–a stock is relative to the rest of the market. For beta to provide any useful insight, the market that is used as a benchmark should be related to the stock. For example, calculating a bond ETF's beta using the S&P 500 as the benchmark would not provide much helpful insight for an investor because bonds and stocks are too dissimilar.

Ultimately, an investor is using beta to try to gauge how much risk a stock is adding to a portfolio. While a stock that deviates very little from the market doesn’t add a lot of risk to a portfolio, it also doesn’t increase the potential for greater returns.

In order to make sure that a specific stock is being compared to the right benchmark, it should have a high R-squared value in relation to the benchmark. R-squared is a statistical measure that shows the percentage of a security's historical price movements that can be explained by movements in the benchmark index. When using beta to determine the degree of systematic risk, a security with a high R-squared value, in relation to its benchmark, could indicate a more relevant benchmark.

One way for a stock investor to think about risk is to split it into two categories. The first category is called systematic risk, which is the risk of the entire market declining. The financial crisis in 2008 is an example of a systematic-risk event; no amount of diversification could have prevented investors from losing value in their stock portfolios. Systematic risk is also known as un-diversifiable risk.

Unsystematic risk, also known as diversifiable risk, is the uncertainty associated with an individual stock or industry. For example, the surprise announcement that the company Lumber Liquidators (LL) had been selling hardwood flooring with dangerous levels of formaldehyde in 2015 is an example of unsystematic risk.2 It was risk that was specific to that company. Unsystematic risk can be partially mitigated through diversification.

Types of Beta Values

- **Beta Value Equal to 1.0:** If a stock has a beta of 1.0, it indicates that its price activity is strongly correlated with the market. A stock with a beta of 1.0 has systematic risk. However, the beta calculation can’t detect any unsystematic risk. Adding a stock to a portfolio with a beta of 1.0 doesn’t add any risk to the portfolio, but it also doesn’t increase the likelihood that the portfolio will provide an excess return.

- **Beta Value Less Than One:** A beta value that is less than 1.0 means that the security is theoretically less volatile than the market. Including this stock in a portfolio makes it less risky than the same portfolio without the stock. For example, utility stocks often have low betas because they tend to move more slowly than market averages.

- **Beta Value Greater Than One:** A beta that is greater than 1.0 indicates that the security's price is theoretically more volatile than the market. For example, if a stock's beta is 1.2, it is assumed to be 20% more volatile than the market. Technology stocks and small cap stocks tend to have higher betas than the market benchmark. This indicates that adding the stock to a portfolio will increase the portfolio’s risk, but may also increase its expected return.

- **Negative Beta Value:** Some stocks have negative betas. A beta of -1.0 means that the stock is inversely correlated to the market benchmark. This stock could be thought of as an opposite, mirror image of the benchmark’s trends. Put options and inverse ETFs are designed to have negative betas. There are also a few industry groups, like gold miners, where a negative beta is also common.

Beta in Theory vs. Beta in Practice

The beta coefficient theory assumes that stock returns are normally distributed from a statistical perspective. However, financial markets are prone to large surprises. In reality, returns aren’t always normally distributed. Therefore, what a stock's beta might predict about a stock’s future movement isn’t always true.

A stock with a very low beta could have smaller price swings, yet it could still be in a long-term downtrend. So, adding a down-trending stock with a low beta decreases risk in a portfolio only if the investor defines risk strictly in terms of volatility (rather than as the potential for losses). From a practical perspective, a low beta stock that's experiencing a downtrend isn’t likely to improve a portfolio’s performance.

Similarly, a high beta stock that is volatile in a mostly upward direction will increase the risk of a portfolio, but it may add gains as well. It's recommended that investors using beta to evaluate a stock also evaluate it from other perspectives—such as fundamental or technical factors—before assuming it will add or remove risk from a portfolio.

- Disadvantages of Beta

While beta can offer some useful information when evaluating a stock, it does have some limitations. Beta is useful in determining a security's short-term risk, and for analyzing volatility to arrive at equity costs when using the CAPM. However, since beta is calculated using historical data points, it becomes less meaningful for investors looking to predict a stock's future movements.

Beta is also less useful for long-term investments since a stock's volatility can change significantly from year to year, depending upon the company's growth stage and other factors.

4.8. Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) describes the relationship between systematic risk and expected return for assets, particularly stocks. CAPM is widely used throughout finance for pricing risky securities and generating expected returns for assets given the risk of those assets and cost of capital. It shows that the expected return on a security is equal to the risk-free return plus a risk premium, which is based on the beta of that security.

The formula for calculating the expected return of an asset given its risk is as follows:

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

Where:

ER_i = expected return of investment

R_f = risk free rate

B_i = beta of the investment

$(ER_m - R_f)$ = market risk premium

- A risk premium is a rate of return greater than the risk-free rate. When investing, investors desire a higher risk premium when taking on more risky investments.
- "Expected return" is a long-term assumption about how an investment will play out over its entire life.
- The risk-free rate should correspond to the country where the investment is being made, and the maturity of the bond should match the time horizon of the investment.

Professional convention, however, is to typically use the 10-year rate no matter what, because it's the most heavily quoted and most liquid bond.

- The beta (denoted as "Bi" in the CAPM formula) is a measure of a stock's risk (volatility of returns) reflected by measuring the fluctuation of its price changes relative to the overall market. In other words, it is the stock's sensitivity to market risk.

- The market risk premium represents the additional return over and above the risk-free rate, which is required to compensate investors for investing in a riskier asset class.

Investors expect to be compensated for risk and the time value of money. The risk-free rate in the CAPM formula accounts for the time value of money. The other components of the CAPM formula account for the investor taking on additional risk.

The beta of a potential investment is a measure of how much risk the investment will add to a portfolio that looks like the market. If a stock is riskier than the market, it will have a beta greater than one. If a stock has a beta of less than one, the formula assumes it will reduce the risk of a portfolio.

A stock's beta is then multiplied by the market risk premium, which is the return expected from the market above the risk-free rate. The risk-free rate is then added to the product of the stock's beta and the market risk premium. The result should give an investor the required return or discount rate they can use to find the value of an asset.

The goal of the CAPM formula is to evaluate whether a stock is fairly valued when its risk and the time value of money are compared to its expected return.

- Problems With the CAPM

There are several assumptions behind the CAPM formula that have been shown not to hold in reality. Modern financial theory rests on two assumptions: (1) securities markets are very competitive and efficient (that is, relevant information about the companies is quickly and universally distributed and absorbed); (2) these markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments.

Despite these issues, the CAPM formula is still widely used because it is simple and allows for easy comparisons of investment alternatives.

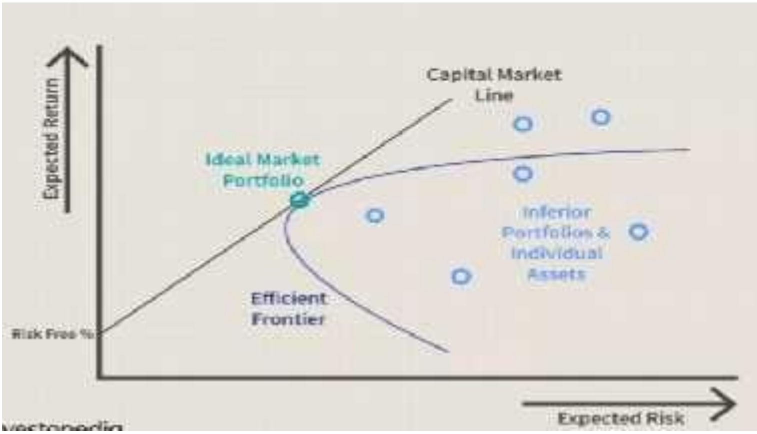
Including beta in the formula assumes that risk can be measured by a stock's price volatility. However, price movements in both directions are not equally risky. The look-back period to determine a stock's volatility is not standard because stock returns (and risk) are not normally distributed.

The CAPM also assumes that the risk-free rate will remain constant over the discounting period. An increase in the risk-free rate also increases the cost of the capital used in the investment and could make the stock look overvalued. The market portfolio that is used to find the market risk premium is only a theoretical value and is not an asset that can be purchased or invested in as an alternative to the stock. Most of the time, investors will use a major stock index, like the S&P 500, to substitute for the market, which is an imperfect comparison.

The most serious critique of the CAPM is the assumption that future cash flows can be estimated for the discounting process. If an investor could estimate the future return of a stock with a high level of accuracy, the CAPM would not be necessary.

- The CAPM and the Efficient Frontier

Using the CAPM to build a portfolio is supposed to help an investor manage their risk. If an investor were able to use the CAPM to perfectly optimize a portfolio's return relative to risk, it would exist on a curve called the efficient frontier, as shown on the following graph.



The graph shows how greater expected returns (y-axis) require greater expected risk (x-axis). Modern Portfolio Theory suggests that starting with the risk-free rate, the expected return of a portfolio increases as the risk increases. Any portfolio that fits on the Capital Market Line (CML) is better than any possible portfolio to the right of that line, but at some point, a theoretical portfolio can be constructed on the CML with the best return for the amount of risk being taken.

The CML and efficient frontier may be difficult to define, but it illustrates an important concept for investors: there is a trade-off between increased return and increased risk. Because it isn't possible to perfectly build a portfolio that fits on the CML, it is more common for investors to take on too much risk as they seek additional return.

The CAPM uses the principles of Modern Portfolio Theory to determine if a security is fairly valued. It relies on assumptions about investor behaviors, risk and return distributions, and market fundamentals that don’t match reality. However, the underlying concepts of CAPM and the associated efficient frontier can help investors understand the relationship between expected risk and reward as they make better decisions about adding securities to a portfolio.

Module V

Derivative Markets

5.1. Derivative Markets

The word Derivative is derived from mathematics which refers to a variable that has been derived from another variable. In simple sense, Derivative has no independent value of its own; its value is obtained from the value of an underlying asset. For example curd is a derivative of milk or similarly, measure of temperature is derived from the measurement of Fahrenheit. In financial world, a derivative is a financial product which derives its value from another asset. For ex. Sensex is a derivative of 30 shares at Bombay Stock Exchange and NIFTY is a derivative of 50 shares at NSE.

Features of Derivatives

1. Derivatives are the part of secondary market and no funds can be raised through derivatives.

2. The transactions in the Derivative are settled by taking offsetting position in the same derivatives.

3. No limit on the number of units transacted because there is no physical asset involved.

4. Derivative market is quite liquid in nature.

5. These are tailor made instruments and its use depends upon investors requirement.

Two Purposes of Derivatives

- Price Discovery of the underlying asset

Prices in an organized derivative market reflect the perception of market participants about the future and lead the prices of underlying to the perceived future level. Price of derivative coincides with price of underlying at the expiration date. Thus, it helps in price discovery.

- Tool for Risk management

Derivative instruments helps in transfer risks through hedging from the hedger to the speculator.

Derivative Types

- **Options:** Options are financial derivative contracts that give the buyer the right, but not the obligation, to buy or sell an underlying asset at a specific price (referred to as the strike price) during a specific period of time. American options can be exercised at any time before the expiry of its option period. On the other hand, European options can only be exercised on its expiration date.

- **A forward contract** is a non-standardized contract between two parties to buy or sell an asset at a specified future time, at a price agreed upon today. The party agreeing to buy the underlying asset in the future assumes a long position, and the party agreeing to sell the asset in the future assumes a short position. The price agreed upon is called the delivery price, which is equal to the forward price at the time the contract is entered into. The forward price of such a contract is commonly contrasted with the spot price, which is the price at which the asset changes hands on the spot date. The difference between the spot and the forward price is the forward premium or forward discount, generally considered in the form of a profit, or loss, by the purchasing party.

- **A futures contract** differs from a forward contract in that the futures contract is a standardized contract written by a clearing house that operates an exchange where the contract can be bought and sold. On the other hand, the forward contract is a non-standardized contract written by the parties themselves. Forwards also typically have no interim partial settlements – or "true-ups" – in margin requirements like futures, such that the parties do not exchange additional property, securing the party at gain, and the entire unrealized gain or loss builds up while the contract is open.

- **Swaps** are derivatives in which counterparties exchange cash flows of one party's financial instrument for those of the other party's financial instrument. For example, in the case of a swap involving two bonds, the benefits in question can be the periodic interest (or coupon) payments associated with the bonds. Specifically, the two counterparties agree to exchange one stream of cash flows against another stream. The swap agreement defines the dates when the cash flows are to be paid and the way they are calculated. Usually at the time when the contract is initiated at least one of these series of cash flows is determined by a random or uncertain variable such as an interest rate, foreign exchange rate, equity price or commodity price.

Participants of Derivatives Market:

1. Hedgers

2. Speculators

3. Arbitrageurs

1. Hedgers

One of the main purposes for which derivative trading has been initiated is to hedge or provide protection to the parties to a contract. Hedgers have risk exposure which they offset by a derivative and seek to protect themselves against price movements in an asset in which they have interest. For example, an American buying shares of an Indian company on an Indian exchange would be exposed to exchange-rate risk while holding that stock. In order to reduce this risk, the investor could purchase currency futures of dollars to lock in a specified exchange rate for the future stock sale and currency conversion back into dollars.

2. Speculators

Speculators are the participants who are ready to take risk in expectation of return. They take position in the market either expecting that the prices will go up or expecting that the prices will go down. They may go long (buy) or short (sell) based on their expectations. However, they have naked positions and therefore, they are inviting risk for earning a return. The speculators create volumes of trading in the derivative market and hedgers & arbitrageurs get counter party for other traders. The speculators create volumes of trading in the derivative market and hedgers & arbitrageurs get counterparty for their trades.

3. **Arbitrageurs**

The arbitraging refers to locking in a risk less profit by simultaneously entering into two transactions in two different markets separated geographically or timing. The profit opportunities may occur due to price differences in two different markets but could not last for long due to arbitraging. Arbitrageurs may deal in to cash and derivatives market or only derivatives market for different periods of time earning arbitrage profits. Their actions shall narrow down the differential in prices. For example, arbitrageurs may buy in the spot market and sell in the futures market

5.2. Forward Contracts

Forward Contract is an agreement made today between a buyer and a seller wherein the seller is under obligation to deliver a specified asset of specified quality and quantity to the buyer on a future date and place is specified at a price agreed upon today. The buyer in return has to pay the seller a pre-negotiated price in exchange for the delivery. Forwards are not marketable; once a firm enters into a forward contract there is no convenient way to trade out of it except that of reversing the trade between the same parties. For example: Wheat farmer selling his harvest at a known price at a future date in order to eliminate price risk.

Features of Forward Contract

1. Forward contracts are not standardized form of contracts.
2. They are over the counter transactions.(not traded recognized exchanges)
3. Every order is separate and is determined with respect to the contract size, expiration date, asset type and quality. The date

and price of the contract is unique and decided in advance by the two trading parties.

4. Futures contracts are bilateral agreements and exposed to counter party risk.

5. In forward contract, both the parties takes the opposite position. One party agrees to buy the asset at specified price at future date; it is said to have taken a long position. Another party takes opposite i.e short position; agrees to sell the same asset at the same date on the price agreed upon. A party without obligation offsetting futures contract is said to have an open position.

Benefits of Forward contracts

Forward contract can be used to secure or hedge or lock in the price of purchase of asset on the future commitment date For Ex. A bread factory may want to buy wheat forward in order to assist production planning without taking risk of price fluctuations. Price discovery is another use of forward prices to predict spot price that will prevail in future. Also, no cost is involved as margins are involved in forward contracts. It is entered in to by two parties generally known to each other.

Limitations of Forward contract

1. Forward contract have counter party risk and in case of default by other party, the aggrieved party may have to suffer a loss.

2. No party can take benefit of favorable price movements as squaring off is not possible in forward contracts.

3. Forward contracts are illiquid contracts as it is difficult to get counter party at one's terms

Determination of Forward Prices

Forward price is the predetermined delivery price for an underlying commodity, currency, or financial asset as decided by the buyer and the seller of the forward contract, to be paid at a predetermined date in the future. At the inception of a forward contract, the forward price makes the value of the contract zero, but changes in the price of the underlying will cause the forward to take on a positive or negative value.

When the underlying asset in the forward contract does not pay any dividends, the forward price can be calculated using the following formula:

$$F = S \times e^{(r \times t)}$$

Where:

F = the contract's forward price

S = the underlying asset's current spot price

e = the mathematical irrational constant approximated by 2.7183

r = the risk free rate that applies to the life of the forward contract

t = the delivery date in years

5.3. Futures Contracts

Any contract which is standardized involving two parties having an agreement to buy or sell an asset with specific quantity and quality on a price which is agreed today for future delivery.

Standardization of Future contract

1. Underlying asset can be stock, commodity, interest rate, bonds, Govt securities.

2. Settlement can be cash or physical delivery.

3. The amount and units of the underlying asset per contract is specified.

4. Delivery month and the grade in deliverable is specified.

5. Last trading date id specified.

Features of Future contract

1. Futures are standardized contracts that are to run in either the final cash settlement or assets are delivered at later stage. Certain future contracts such as stocks or currency, settled in cash on the price differentials. For example, the futures of Reliance share can be traded on NSE and future of gold can be traded on MCX.

2. These contracts trading on organized futures exchanges with a clearing organization that serves as an intermediary between the parties.

3. Both parties pay margin on Clearing Association and are generally settled by marked to market every day.

4. Each futures contract has identified a relevant month which is the month of the contract delivery or permanently settlement. These contracts are recognised with their delivery month. For example: .Futures of Reliance in January can be future of January, futures of February or futures of March for 1, 2, 3 months respectively.

Future contract is different from trading an underlying stock in the sense that when you buy a stock you pay full value of the transaction (i.e. the number of shares multiplied by market price of each share) but in case of futures, you have to pay margin.

Difference between Forward and Futures contract

Feature	**Forward contracts**	**Future contracts**
Operational mechanism	Traded directly between contracting parties (not traded on the exchanges)	Traded on the exchanges
Contract specifications	Differ from trade on trade	Contracts are standardised contracts
Counter party risk	Exists. But, sometimes jettisoned to a guarantor	Exists. But, assumed by the clearing agency, which becomes the counter party to all trades or unconditionally guarantees their settlement.
Liquidation profile	Low, as contracts are tailor-made contracts catering to the needs of the parties involved. Further, they are not	High, as contracts are standardised exchange-traded contracts

	easily accessible to other market participants.	
Price discovery	Not efficient, as markets are scattered	Efficient, as markets are centralised and all buyers and sellers come to a common platform to discover the price through a common order book
Quality of information and its dissemination	Quality of information may be poor. Speed of information dissemination is weak	As futures are traded on a nation-wide basis, every bit of decision-related information gets disseminated very fast
Examples	Currency market in India	Commodities futures, index futures and individual stock futures in India

Key Differences between Forwards and Futures

A standardised forward contract is a futures contract. The key differences between forwards and futures are as follows:

- A forward contract is tailor-made contract (the terms are negotiated between the buyer and seller), whereas a futures contract is a standardised contract (quantity, date and delivery conditions are standardised).

- While there is no secondary market for forward contracts, the futures contracts are traded on organised exchanges.

- Forward contracts usually end with deliveries, where as futures contracts are typically settled with the differences.

- Usually no collateral is required for a forward contract. In a futures contract, however, a margin is required.

- Forward contracts are settled on the maturity date, whereas futures contracts are 'market to market' on a daily basis. This means that profits and losses on futures contracts are settled daily.

- In a forward contract, both the parties are exposed to credit risk, because irrespective of which way the price moves, one of the parties will have an incentive to default.

5.4.Theories of Future Prices

Futures are derivative products whose value depends largely on the price of the underlying stocks or indices. However, the pricing is not that direct. There remains a difference between the prices of the underlying asset in the cash segment and in the derivatives segment. This difference can be understood through three pricing models for futures contracts. These will allow you to estimate how the price of a stock futures or index futures contract might behave. These are:

- The Cost of Carry Model
- The Expectation Model
- Capital Asset Pricing Model

However, that these models merely gives a platform on which to base our understanding of futures prices. That said, being aware of these theories gives a feel of what we can expect from the futures price of a stock or an index.

1. The cost of carry model

The Cost of Carry Model assumes that markets tend to be perfectly efficient. This means there are no differences in the cash and futures price. This, thereby, eliminates any opportunity for arbitrage – the phenomenon where traders take advantage of price differences in two or more markets. When there is no opportunity for arbitrage, investors are indifferent to the spot and futures market prices while they trade in the underlying asset. This is because their final earnings are eventually the same. The model also assumes, for simplicity sake, that the contract is held till maturity, so that a fair price can be arrived at. In short, the price of a futures contract (FC) will be equal to the spot price (SP) plus the net cost incurred in carrying the asset till the maturity date of the futures contract.

$$FC = SP + (Carry\ Cost - Carry\ Return)$$

Here Carry Cost refers to the cost of holding the asset till the futures contract matures. This could include storage cost, interest paid to acquire and hold the asset, financing costs, etc. Carry Return refers to any income derived from the asset while holding it like dividends, bonuses, etc. While calculating the futures price of an index, the Carry Return refers to the average returns given by the index during the holding period in the cash market. A net of these two is called the Net Cost of Carry. The bottom line of this pricing model is that keeping a position open in the cash market can have benefits or costs. The price of a futures contract basically reflects these costs or benefits to charge or reward you accordingly.

2. Expectancy model of futures pricing

The Expectancy Model of futures pricing states that the futures price of an asset is basically what the spot price of the asset is expected to be in the future. This means, if the overall market sentiment leans towards a higher price for an asset in the future, the futures price of the asset will be positive. In the exact same way, a rise in bearish sentiments in the market would lead to a fall in the futures price of the asset. Unlike the Cost of Carry model, this model believes that there is no relationship between the present spot price of the asset and its futures price. What matters is only what the future spot price of the asset is expected to be. This is also why many stock market participants look to the trends in futures prices to anticipate the price fluctuation in the cash segment.

3. Capital Asset Pricing Model (CAPM)

The capital asset pricing model, or CAPM, is a special model that's used in finance to calculate the relationship between expected dividends as well as the risk of investing in specific equity. The CAPM model is used to determine the expected returns for a security. This can be compared with the risk-free returns and the addition of a beta.

To properly assess the capital asset pricing model, it is necessary to understand both systematic and unsystematic risk. Systematic risks are all general dangers that are involved in the investment of any type. There are many risks that could occur, such as inflation, wars, and recessions. These are just a few examples of systematic risk. On the other hand, unsystematic risks refer to specific risks associated with investing in particular stocks or equity.

Unsystematic risks, on the other hand, are not considered to be threats and are generally shared by the market. CAPM focuses on systematic risks in securities and can thus predict whether certain investments will fail.

The CAPM formula is provided by –

$$R_a = R_f + \beta(R_m - R_f)$$

These are the different elements of this equation: -

1) Ra = Expected dividend of investment

2) Rf = Risk-free rate

3) Beta = The transaction's underlying transaction

4) (Rm-Rf) = Current Market Risk Premium

The entire formula takes into account the potential returns that an investor could receive due to their risk-taking abilities and longer investment time. In conjunction with current market conditions, the beta factor is considered a risk. If the investment risk is greater than the current conditions, then the beta value will be lower than 1. A beta value in this equation will always equal 1. Finally, if the risk is greater than the market norm, the formula's 'Be' value will be higher than 1.

5.5 Relation between Spot Price and Future Price

The main differences between commodity spot prices and futures prices are the delivery dates. Spot prices and futures prices is that spot prices are for immediate buying and selling, while futures contracts delay payment and delivery to predetermined future dates.

The spot price of a commodity is the current cash cost of it for immediate purchase and delivery. The futures price locks in the cost of the commodity that will be delivered at some point other than the present—usually, some months hence.

The difference between the spot price and futures price in the market is called the basis.

Futures prices and spot prices are different numbers because the market is always forward-looking.

The spot price is usually below the futures price. The situation is known as contango. On the other hand, there is backwardation, which is a situation when the spot price exceeds the futures price. In either situation, the futures price is expected to eventually converge with the current market price.

5.6. Hedging in Futures

Hedging is buying or selling futures contract as protection against the risk of loss due to changing prices in the cash market. A short hedge is used when you plan on selling your product at a future date and want to protect yourself against falling prices. A long hedge is used when you plan on buying a commodity such as soybean meal and want to protect against prices increasing. The relationship of local cash price and the futures price is called basis. Basis is calculated by subtracting the price of the appropriate futures contract from the local cash market price. For a short hedge, the more positive (stronger) the basis, the higher the price received for commodity. For a long hedge, the more negative (weaker) the basis, the lower the price paid for commodity. It is very important to note that hedging does not necessarily improve the financial outcome, it just reduces the uncertainty.

5.7. Options

Options are agreements between two parties to buy or sell a security at a certain price. They are most often used to trade stock options, but may be used for other investments as well. If an investor purchases the right to buy an asset at a specific price within a given time frame, he has purchased a call option. On the contrary, if he purchases the right to sell an asset at a given price, he has purchased a put option. The seller has the corresponding obligation to fulfill the transaction that is to sell or buy if the buyer (owner) exercises the option. The buyer pays a premium to the seller for this right. An option that conveys to the owner the right to buy something at a certain price is a "call option"; an option that conveys the right of the owner to sell something at a certain price is a "put option". Both are commonly traded, but for transparency, the call option is more frequently discussed. Options valuation is a topic of ongoing research in academic and practical finance. Fundamentally, the value of an option is commonly decomposed into two parts. The first part is the "intrinsic value", described as the difference between the market value of the underlying and the strike price of the given option. The second part is the "time value", which depends on a set of other factors which, through a multivariable, non-linear interrelationship, reflect the discounted expected value of that difference at expiration.

Although options valuation has been done since the 19th century, the modern approach is based on the Black–Scholes model, which was first published in 1973. Options contracts were used for many centuries, however both trading activity and academic interest increased when, as from 1973, options were issued with standardized terms and traded through a guaranteed clearing house at the Chicago Board Options Exchange. Today many options are created in a standardized form and traded through clearing houses on regulated options exchanges, while other over-the-counter options are written as bilateral, customized contracts between a single buyer and seller, one or both of which may be a dealer or market-maker. Options are part of major category of financial instruments termed as derivative products or simply derivatives.

Features of options:

- A fixed maturity date on which they expire (Expiry date).
- The price at which the option is exercised is called the exercise price or strike price.
- The person who writes the option and is the seller is denoted as the "option writer", and who holds the option and is the buyer, is called "option holder".
- The premium is the price paid for the option by the buyer to the seller.
- A clearing house is interposed between the seller and the buyer which guarantees performance of the contract.

Types of Options:

1. Call Options

A call option gives the purchaser (or buyer) the right to buy an underlying security (e.g., a stock) at a prespecified price called the exercise or strike price (X). In return, the buyer of the call option must pay the writer (or seller) an up-front fee known as a call premium (C). This premium is an immediate negative cash flow for the buyer of the call option. However, he or she potentially stands to make a profit should the underlying stock's price be greater than the exercise price (by an amount exceeding the premium). If the price of the underlying stock is greater than X (the option is referred to as “in the money”), the buyer can exercise the option, buying the stock at X and selling it immediately in the stock market at the current market price, greater than X. If the price of the underlying stock is less than X (the option is referred to as “out of the money”), the buyer of the call would not exercise the option (i.e., buy the stock at X when its market value is less than X). If this is the case when the option matures, the option expires unexercised. The same is true when the underlying stock price is exactly equal to X when the option expires (the option is referred to as “at the money”). The call buyer incurs a cost C (the call premium) for the option, and no other cash flows result.

2. A Put Option

A put option gives the option buyer the right to sell an underlying security (e.g., a stock) at a pre-specified price to the writer of the put option. In return, the buyer of the put option must pay the writer (or seller) the put premium (P). If the underlying stock’s price is less than the exercise price (X) (the put option is “in the money”), the buyer will buy the underlying stock in the stock market at less than X and immediately sell it at X by exercising the put option. If the price of the underlying stock is greater than X (the put option is “out of the money”), the buyer of the put option would not exercise the option (i.e., selling the stock at X when its market value is more than X). If this is the case when the option matures, the option expires unexercised. This is also true if the price of the underlying stock is exactly equal to X when the option expires (the put option is trading “at the money”). The put option buyer incurs a cost P for the option, and no other cash flows result.

3. Stock Options.

The underlying asset on a stock option contract is the stock of a publicly traded company. One option generally involves 100 shares of the underlying company's stock. The same stock can have many different call and put options differentiated by expiration and strike price. Further, the quote gives an indication of whether the call and put options are trading in, out of, or at the money.

4. Credit Options

Options also have a potential use in hedging the credit risk of a financial institution. Compared to their use in hedging interest rate risk, options used to hedge credit risk are a relatively new phenomenon. Two alternative credit option derivatives exist to hedge credit risk on a balance sheet: credit spread call options and digital default options. A credit spread call option is a call option whose payoff increases as the (default) risk premium or yield spread on a specified benchmark bond of the borrower increases above some exercise spread.

Different Uses of Options:

There are a number of reasons for being either a writer or a buyer of options. The writer assures an uncertain amount of risk for a certain amount of money, whereas the buyer assures an uncertain potential gain for a fixed cost. Such a situation can lead to a number of reasons for using options.

However, fundamental to either writing or buying an option is the promise that option is fairly valued in terms of the possible outcomes. If the option is not fairly priced then, of course, an additional source of profit or loss is introduced, and the writer or buyer of such a contract may be subject to an additional handicap that will reduce his or her return.

The reasons for writing option contracts are varied, but three of the most common are to cash additional income on a securities portfolio, the fact that option buyers are not as sophisticated as writers, and to hedge a long position.

It is sometimes argued that option writing is a source of additional income for the portfolio of an investor with a large portfolio of securities. Such an approach assumes that the portfolio manager can guess the direction of specific stock prices closely rough to make this strategy worth-while.

What cannot be overlooked is that the writer gives up certain rights when the option is written. For example, suppose a call option is written. In this case, the writer would presumably cover the call by giving up securities from his or her portfolio. Hence, the writer is giving up any appreciation beyond the striking price plus the option premium.

Second, it is believed by some that the buyer of options is not as sophisticated as the writers. The proponents of this view argue that option writers are the most sophisticated participants in the securities market and view argue that option premiums simply as additional income.

However, it should be held that this view pre-supposes that the buyers are "lambs ready to be shorn" whether this view is correct or not is unclear, but it follows that over the long-term they may find option writing an unprofitable undertaking. There are a number of reasons for buying options; two of the most common are leverage and changing the risk complexion of a portfolio. The term leverage in connection with options indicates buyer being able to control more securities than could be done with realistic margin requirements.

In other words, with the use of margins, the buyer of securities can but more securities and hopefully make a greater profit than could be done by taking a basic long position. Puts and calls can be used in much the same fashion and perhaps provide a higher return. Another reason of buying options is to change the risk complexion of a portfolio of securities. It should be noted that this benefit of options is available not only to buyers but also to writers. Therefore, they permit the portfolio manager to undertake as much or as little risk as he or she feels is appropriate at a point of time. They also give additional flexibility in setting the amount or risk the portfolio manager is willing to accept with respect to a specific portfolio.

5.8. Put-Call parity theorem

Put-Call parity theorem says that premium (price) of a call option implies a certain the fair price for corresponding put options provided the put options have the same strike price, underlying and expiry, and vice versa. It also shows the three-sided relationship between a call, a put, and underlying security. The theory was first identified by Hans Stoll in 1969.

The term "put-call" parity refers to a principle that defines the relationship between the price of European put and call options of the same class. Put simply, this concept highlights the consistencies of these same classes. Put and call options must have the same underlying asset, strike price, and expiration date in order to be in the same class. The put-call parity, which only applies to European options, can be determined by a set equation.

There exists a connection between the European call options and the European put options prices, and this relationship is defined by the Put call parity. Though, the security, the strike price, and the ending month should be the same for the securities to establish the relation.

Put call parity states that holding up of the long European call with the short European put simultaneously will yield out the same return when you will be holding up a forward contract having the identical basic asset, as well as the expiry date. And here the forward price will be equivalent to the option's strike amount.

Put call parity equation:

$$c + PV(x) = P + S$$

Where in the above put call parity equation:

- C = the European call options price
- PV(x) = the current value of the strike price (x), which is reduced from the price on the end date at the risk-free amount
- P = the European put options or security price
- S = the present market value of the underlying asset or the spot price

Need for Put Call Parity

The need for Put-Call Parity arises to compute the current worth of the cash element, that exists with an appropriate risk permitted interest rate.

For Example: Take two portfolio A and portfolio B, where Portfolio A has a European call decision and cash which is equivalent to the total shares enclosed by the call option that is being grown up by the call's striking price. And taking portfolio B which has a European put option as well as the underlying asset. So, we get the options as follows:

- **Portfolio A** (having options as) = Call + Cash, (wherever the Cash is equal to the Call Strike Price)
- **Portfolio B** (having options as) = Put + Underlying Asset

The Portfolio A and Portfolio B having Call, put, cash and asset option is depicted in the above figure. And from the above figure of Portfolio A having call option and cash, and the portfolio B having put option and asset. we observe that:

- **Call + Cash = Put + Underlying Asset**
- **For example:** Sept 20 Call + $2500 = Sept 20 Put + 100 ABC Stock
- Thus, in order to calculate the current value of the cash component in the above equation we need the put call parity equation which is as: C + PV(x) = P + S

Important Terminologies used in put call Options

- S0 = Stock price existing today,
- X = the Strike price
- T = Time to expiration of the securities
- r = Risk-free rate of return
- C0 = the European call option premium
- P0 = the European put option premium

Put call parity arbitrage:

The put call parity arbitrage defines the opportunity to yield out profit from the price variances that exists in a different market of a financial security. So, the put call parity arbitrage exits where the call put option does not apply at all. Or where we see that one side of the put call equation is greater than the other, or there exists some variation in the put call equation, there the put call parity arbitrage exists.

5.9. Option Pricing Models

Option pricing theory has made vast strides since 1972, when Black and Scholes published their path-breaking paper providing a model for valuing dividend-protected European options. Black and Scholes used a “replicating portfolio” — a portfolio composed of the underlying asset and the risk-free asset that had the same cash flows as the option being valued — to come up with their final formulation. While their derivation is mathematically complicated, there is a simpler binomial model for valuing options that draws on the same logic.

The Binomial Option Pricing Model

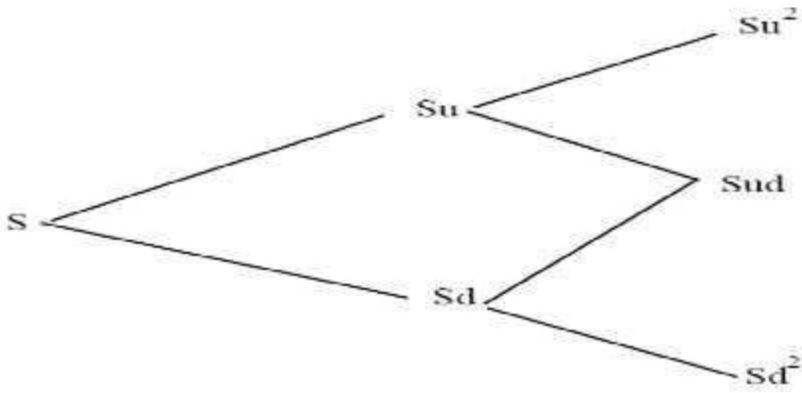
In finance, the binomial options pricing model (BOPM) provides a generalizable numerical method for the valuation of options. Essentially, the model uses a "discrete-time" (lattice based) model of the varying price over time of the underlying financial instrument, addressing cases where the closed-form Black–Scholes formula is wanting. The binomial model was first proposed by William Sharpe in the 1978 edition of Investments and formalized by Cox, Ross and Rubinstein in 1979 and by Rendleman and Bartter in that same year.

The binomial option pricing model is based upon a simple formulation for the asset price process in which the asset, in any time period, can move to one of two possible prices. It has been widely used since it is able to handle a variety of conditions for which other models cannot easily be applied. This is largely because the BOPM is based on the description of an underlying instrument over a period of time rather than a single point. As a consequence, it is used to value American options that are exercisable at any time in a given interval as well as Bermudan options that are exercisable at specific instances of time. Being relatively simple, the model is readily implementable in computer software (including a spreadsheet).

Although computationally slower than the Black–Scholes formula, it is more accurate, particularly for longer-dated options on securities with dividend payments. For these reasons, various versions of the binomial model are widely used by practitioners in the options markets

The general formulation of a stock price process that follows the binomial is shown in figure 5.1. In this figure, S is the current stock price; the price moves up to Su with probability p and down to Sd with probability 1-p in any time period.

Figure 5.1.: General Formulation for Binomial Price Path



The Determinants of Value

The binomial model provides insight into the determinants of option value. The value of an option is not determined by the expected price of the asset but by its current price, which, of course, reflects expectations about the future. This is a direct consequence of arbitrage. If the option value deviates from the value of the replicating portfolio, investors can create an arbitrage position, i.e., one that requires no investment, involves no risk, and delivers positive returns. The cash flows on the two positions will offset each other, leading to no cash flows in subsequent periods. The option value also increases as the time to expiration is extended, as the price movements (u and d) increase, and with increases in the interest rate.

While the binomial model provides an intuitive feel for the determinants of option value, it requires a large number of inputs, in terms of expected future prices at each node. As we make time periods shorter in the binomial model, we can make one of two assumptions about asset prices. We can assume that price changes become smaller as periods get shorter; this leads to price changes becoming infinitesimally small as time periods approach zero, leading to a continuous price process. Alternatively, we can assume that price changes stay large even as the period gets shorter; this leads to a jump price process, where prices can jump in any period.

The Black-Scholes Option Pricing Model

Black-Scholes is a pricing model used to determine the fair price or theoretical value for a call or a put option based on six variables such as volatility, type of option, underlying stock price, time, strike price, and risk-free rate. The quantum of speculation is more in case of stock market derivatives, and hence proper pricing of options eliminates the opportunity for any arbitrage. There are two important models for option pricing – Binomial Model and Black-Scholes Model. The model is used to determine the price of a European call option, which simply means that the option can only be exercised on the expiration date.

Black-Scholes pricing model is largely used by option traders who buy options that are priced under the formula calculated value, and sell options that are priced higher than the Black-Schole calculated value

When the price process is continuous, i.e. price changes becomes smaller as time periods get shorter, the binomial model for pricing options converges on the BlackScholes model. The model, named after its co-creators, Fischer Black and Myron Scholes, allows us to estimate the value of any option using a small number of inputs and has been shown to be remarkably robust in valuing many listed options.

The Model

While the derivation of the Black-Scholes model is far too complicated to present here, it is also based upon the idea of creating a portfolio of the underlying asset and the riskless asset with the same cashflows and hence the same cost as the option being valued. The value of a call option in the Black-Scholes model can be written as a function of the five variables:

S = Current value of the underlying asset

K = Strike price of the option

t = Life to expiration of the option

r = Riskless interest rate corresponding to the life of the option

σ^2 = Variance in the ln(value) of the underlying asset

The value of a call is then:

$$Value\ of\ call = SN(d_1) - Ke^{-rt}N(d_2)$$

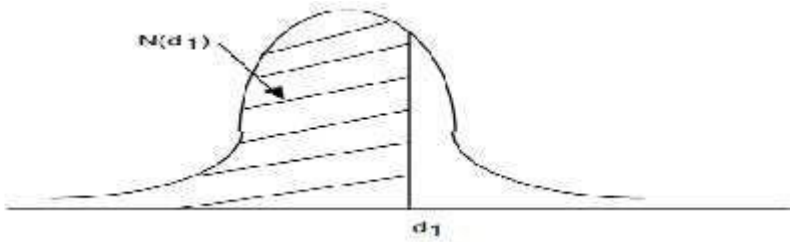
Where,

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

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

Note that e^{-rt} is the present value factor and reflects the fact that the exercise price on the call option does not have to be paid until expiration. N(d1) and N(d2) are probabilities, estimated by using a cumulative standardized normal distribution and the values of d1 and d2 obtained for an option. The cumulative distribution is shown in Figure 5.2.:

Figure 5.2.: Cumulative Normal Distribution



In approximate terms, these probabilities yield the likelihood that an option will generate positive cash flows for its owner at exercise, i.e., when S>K in the case of a call option and when K>S in the case of a put option. The portfolio that replicates the call option is created by buying N(d1) units of the underlying asset, and borrowing Ke-rtN(d2). The portfolio will have the same cash flows as the call option and thus the same value as the option. N(d1), which is the number of units of the underlying asset that are needed to create the replicating portfolio, is called the option delta.

Model Limitations and Fixes

The Black-Scholes model was designed to value options that can be exercised only at maturity and on underlying assets that do not pay dividends. In addition, options are valued based upon the assumption that option exercise does not affect the value of the underlying asset. In practice, assets do pay dividends, options sometimes get exercised early and exercising an option can affect the value of the underlying asset. Adjustments exist. While they are not perfect, adjustments provide partial corrections to the BlackScholes model.

1. Dividends

The payment of a dividend reduces the stock price; note that on the ex-dividend day, the stock price generally declines. Consequently, call options will become less valuable and put options more valuable as expected dividend payments increase. There are two ways of dealing with dividends in the Black Scholes:

1· Short-term Options: One approach to dealing with dividends is to estimate the present value of expected dividends that will be paid by the underlying asset during the option life and subtract it from the current value of the asset to use as S in the model. Modified Stock Price = Current Stock Price – Present value of expected dividends during the life of the option

2.· Long Term Options: Since it becomes impractical to estimate the present value of dividends as the option life becomes longer, we would suggest an alternate approach. If the dividend yield (y = dividends/current value of the asset) on the underlying asset is expected to remain unchanged during the life of the option, the Black-Scholes model can be modified to take dividends into account.

$$C = Se^{-yt}N(d_1) - Ke^{-rt}N(d_2)$$

where

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

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

From an intuitive standpoint, the adjustments have two effects. First, the value of the asset is discounted back to the present at the dividend yield to take into account the expected drop in asset value resulting from dividend payments. Second, the interest rate is offset by the dividend yield to reflect the lower carrying cost from holding the asset (in the replicating portfolio). The net effect will be a reduction in the value of calls estimated using this model.

1. Early Exercise

The Black-Scholes model was designed to value options that can be exercised only at expiration. Options with this characteristic are called European options. In contrast, most options that we encounter in practice can be exercised any time until expiration. These options are called American options. The possibility of early exercise makes American options more valuable than otherwise similar European options; it also makes them more difficult to value. In general, though, with traded options, it is almost always better to sell the option to someone else rather than exercise early, since options have a time premium, i.e., they sell for more than their exercise value. There are two exceptions. One occurs when the underlying asset pays large dividends, thus reducing the expected value of the asset. In this case, call options may be exercised just before an ex-dividend date, if the time premium on the options is less than the expected decline in asset value as a consequence of the dividend payment. The other exception arises when an investor holds both the underlying asset and deep in-the-money puts, i.e., puts with strike prices well above the current price of the underlying asset, on that asset and at a time when interest rates are high. In this case, the time premium on the put may be less than the potential gain from exercising the put early and earning interest on the exercise price.

There are two basic ways of dealing with the possibility of early exercise. One is to continue to use the unadjusted Black-Scholes model and regard the resulting value as a floor or conservative estimate of the true value. The other is to try to adjust the value of the option for the possibility of early exercise. There are two approaches for doing so. One uses the Black-Scholes to value the option to each potential exercise date. With options on stocks, this basically requires that we value options to each ex-dividend day and choose the maximum of the estimated call values. The second approach is to use a modified version of the binomial model to consider the possibility of early exercise. In this version, the up and down movements for asset prices in each period can be estimated from the variance and the length of each period.

2. The Impact of Exercise On The Value Of The Underlying Asset

   The Black-Scholes model is based upon the assumption that exercising an option does not affect the value of the underlying asset. This may be true for listed options on stocks, but it is not true for some types of options. For instance, the exercise of warrants increases the number of shares outstanding and brings fresh cash into the firm, both of which will affect the stock price. The expected negative impact (dilution) of exercise will decrease the value of warrants compared to otherwise similar call options. The adjustment for dilution in the Black-Scholes to the stock price is fairly simple. The stock price is adjusted for the expected dilution from the exercise of the options.