SECURITY ANALYSIS AND PORTFOLO MANAGEMNT: UNIT-4

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PORTFOLIO ANALYSIS

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Portfolio analysis

- Portfolio analysis begins where security analysis ends.
- Portfolio refers to invest in a group of securities rather to invest in a single security.

"Don't put all your eggs in one basket".

- Portfolio analysis is the determination of the future risk and return in holding various combinations of individual securities.
- Portfolio analysis helps to make the investment activity more rewarding and less risky.

Portfolio Analysis

- Portfolio analysis is broadly carried out for each asset at two levels:

  **Risk aversion*: This method analyzes the portfolio composition while considering the risk appetite of an investor. Some investors may prefer to play safe and accept low profits rather than invest in risky assets that can generate high returns.

  **Analyzing returns*: While performing portfolio analysis, prospective returns are calculated through the average and compound return methods. An average return is simply the arithmetic average of returns from individual assets. However, compound return is the arithmetic mean that considers the cumulative effect on overall returns.

PORTFOLIO ANALYSIS

- The concept of diversification goes side by side with the portfolio analysis.
- Diversification aims at reduction and even elimination of non systematic risk and achieving the specific objective of the investors.
- An investor can even estimate his expected return and expected risk level of a given portfolio of assets from proper diversification.

TRADITIONAL VS MODERN PORTFOLIO ANALYSIS

TRADITIONAL PORTFOLIO ANALYSIS

- Traditional theory analyse the individual securities under the constraint of risk and return.
- This theory assumes that the selection of securities should be on the basis of lowest risk as measured by its standard deviation from the mean of expected returns.
- There exists a direct relationship between the variability of returns and risk under this approach.
- The greater is the variability of returns, the greater is the risk and the vice versa.

TRADITIONAL VS MODERN PORTFOLIO ANALYSIS

- Thus, the investor chooses assets with lowest variability of returns.
- The method of *finding the return on an individual security* is by finding out
  - * the amounts of dividend that have been given by the company.
  - * the price earnings ratio.
  - * the common holding period, and
  - * the estimation of market value of shares.

TRADITIONAL VS MODERN PORTFOLIO ANALYSIS

MODERN PORTFOLIO ANALYSIS

- Modern Portfolio theory (MPT) a hypothesis put forth by Harry Markowitz in his paper "Portfolio Selection," (published in 1952 by the *Journal of Finance)*.
- It is an investment theory based on the idea that risk-averse investors can construct portfolios to optimize or maximize expected return based on a given level of market risk, emphasizing that risk is an inherent part of higher reward.
- The modern portfolio theory emphasis the need for maximization of returns through a combination of securities whose total variability is lower.
- It is not necessary that the success could be achieved by trying to get all securities of minimum risk.

TRADITIONAL VS MODERN PORTFOLIO ANALYSIS

- By combining a security of low risk with another security of high risk, success can be achieved by an investor in making a choice of investments.
- As per the modern theory, expected returns, the variance of these returns and covariance of the returns of the securities within the portfolio are to be considered for the choice of the portfolio.
- A portfolio is said to be efficient, if it is expected to yield the highest return possible for the lower risk or a given level of risk.

RETURN ON PORTFOLIO

- The return on portfolio measures the rate of return on a portfolio measured over a period of time.
- Each security in a portfolio contributes returns in the proportion of its investment in security.
- The rate of return on a portfolio can be calculated by *Weighted Average Rate of return* on the various assets within the portfolio.
- This method is particularly useful for projecting into the future the rate of return on a portfolio, given projections of the rates of return on the constituents of the portfolio.

THE STANDARD DEVIATION

- It is slightly more complex but preferable.
- In this the deviations are squared, making all values positive.
- Then the weighted average of these amounts is taken, using the probabilities as weights.
- The result is termed as variance.
- It is converted into original units by taking the square root. This result is termed as standard deviation.

NON-DIVERSIFIABLE RISK

- If an investor holds only one stock, there is no question of diversification and his risk is therefore the standard deviation of the stock.
- For a diversified investor, the risk of the stock is only that portion of the total risk that cannot be diversified away or its non diversifiable risk.
- The non diversifiable risk is generally measured by Beta (β) coefficient.
- β measure the relative risk associated with any individual portfolio as measured in relation to the risk of the market portfolio

NON-DIVERSIFIABLE RISK

- Ꞵ = Non diversifiable risk of asset or portfolio
- A Ꞵ of 1.0 indicates an asset of average risk, a Ꞵ greater than 1.0 indicates above average risk and the Ꞵ less than 1.0 indicates below average risk.
- In the case of a market portfolio, all the diversification has been done. Thus the risk of portfolio is all non diversifiable risk which cannot be avoided.

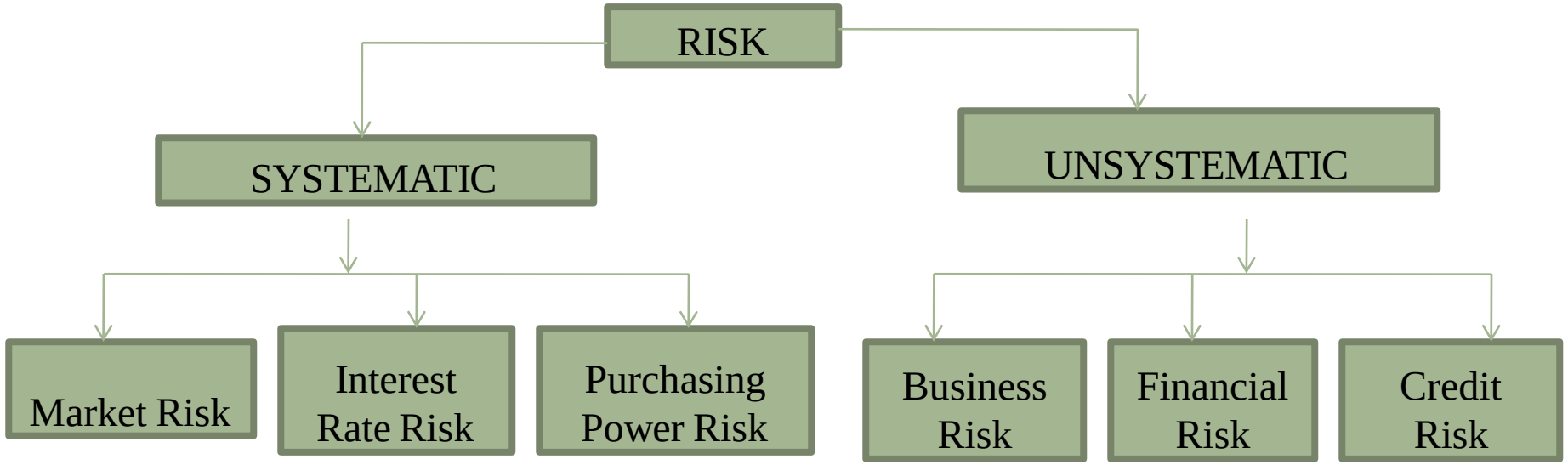
RISK AND RETURN

RISK

Risk refers to the possibility that the actual outcome of an investment will differ from its expected outcome.

In other words, risk is the possibility of loss or the probable outcome of all the possible events. Most investors are concerned about the actual outcome being less than the expected outcome. The degree of risk depends upon the features of assets, investment instruments, mode of investment etc. the wider the range of possible outcomes, the grater the risk.

CLASSIFICATION OF RISK



RETURN

The Return on an asset or investment for a given period is the annual income received plus any change in market price expressed as a percent of opening market price.

Return is the primary motivating force that drives investment. It represents the reward for undertaking investment.

Beta (βa)

The Beta is a measure of the volatility of a stock with respect to the market in general. The fluctuations that will be caused in the stock due to a change in market conditions is denoted by Beta.

Beta is common measure of risk. Beta measures the amount of systematic risk an individual security or an industrial sector has relative to the whole stock market.

The market has a beta of 1, and it can be used to gauge the risk of a security. If a security's beta is equal to 1, the security's price moves in time step with the market. A security with a beta greater than 1 indicates that it is more volatile than the market.

Conversely, if a security's beta is less than 1, it indicates that the security is less volatile than the market. For example, suppose a security's beta is 1.5. In theory, the security is 50 percent more volatile than the market.

To calculate the beta of a security, the covariance between the return of the security and the return of the market must be known, as well as the variance of the market returns.

Beta =Covariance / Variance

Covariance=Measure of a stock’s return relative to that of the market

Variance=Measure of how the market moves relative to its mean

Markowitz Model

Harry M. Markowitz is credited with introducing new concepts of risk measurement and their application to the selection of portfolios. He started with the idea of risk aversion of average investors and their desire to maximise the expected return with the least risk.

Markowitz model is thus a theoretical framework for analysis of risk and return and their inter-relationships. He used the statistical analysis for measurement of risk and mathematical programming for selection of assets in a portfolio in an efficient manner. His framework led to the concept of efficient portfolios. An efficient portfolio is expected to yield the highest return for a given level of risk or lowest risk for a given level of return.

Markowitz generated a number of portfolios within a given amount of money or wealth and given preferences of investors for risk and return. Individuals vary widely in their risk tolerance and asset preferences. Their means, expenditures and investment requirements vary from individual to individual. Given the preferences, the portfolio selection is not a simple choice of any one security or securities, but a right combination of securities.

Markowitz emphasized that quality of a portfolio will be different from the quality of individual assets within it. Thus, the combined risk of two assets taken separately is not the same risk of two assets together. Thus, two securities of TISCO do not have the same risk as one security of TISCO and one of Reliance.

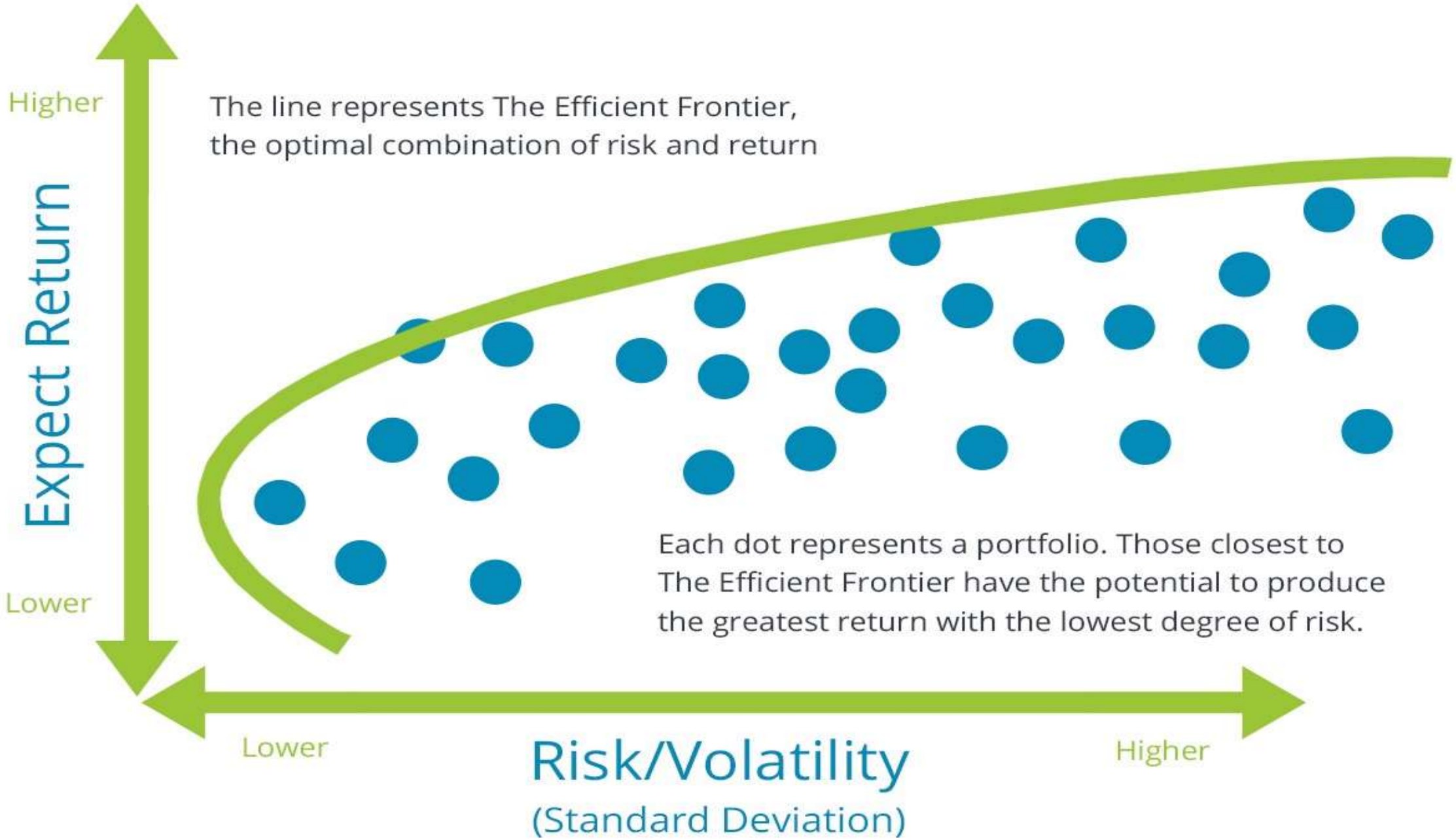
Risk and Reward are two aspects of investment considered by investors. The expected return may vary depending on the assumptions. Risk index is measured by the variance of the distribution around the mean, its range etc., which are in statistical terms called variance and covariance. The qualification of risk and the need for optimisation of return with lowest risk are the contributions of Markowitz. This led to what is called the Modern Portfolio Theory, which emphasizes the trade off between risk and return. If the investor wants a higher return, he has to take higher risk. But he prefers a high return but a low risk and hence the problem of a trade off.

A portfolio of assets involves the selection of securities. A combination of assets or securities is called a portfolio. Each individual investor puts his wealth in a combination of assets depending on his wealth, income and his preferences. The traditional theory of portfolio postulates that selection of assets should be based on lowest risk, as measured by its standard deviation from the mean of expected returns. The greater the variability of returns, the greater is the risk.

Thus, the investor chooses assets with the lowest variability of returns. Taking the return as the appreciation in the share price, if TELCO shares price varies from Rs. 338 to Rs. 580 (with variability of 72%) and Colgate from Rs. 218 to Rs. 315 (with a variability of 44%) during 1998, the investor chooses the Colgate as a less risky share.

Thus, as per the Modern Portfolio Theory, expected returns, the variance of these returns and covariance of the returns of the securities within the portfolio are to be considered for the choice of a portfolio. A portfolio is said to be efficient, if it is expected to yield the highest return possible for the lowest risk or a given level of risk.

A set of efficient portfolios can be generated by using the above process of combining various securities whose combined risk is lowest for a given level of return for the same amount of investment, that the investor is capable of. The theory of Markowitz, as stated above is based on a number of assumptions.


Higher
Expect Return
Lower
The line represents The Efficient Frontier,
the optimal combination of risk and return
Each dot represents a portfolio. Those closest to
The Efficient Frontier have the potential to produce
the greatest return with the lowest degree of risk.
Lower
Risk/Volatility
(Standard Deviation)
Higher

Assumptions of Markowitz Theory:

The Portfolio Theory of Markowitz is based on the following assumptions:

(1) Investors are rational and behave in a manner as to maximise their utility with a given level of income or money.

(2) Investors have free access to fair and correct information on the returns and risk.

(3) The markets are efficient and absorb the information quickly and perfectly.

(4) Investors are risk averse and try to minimise the risk and maximise return.

(5) Investors base decisions on expected returns and variance or standard deviation of these returns from the mean.

(6) Investors choose higher returns to lower returns for a given level of risk.

A portfolio of assets under the above assumptions is considered efficient if no other asset or portfolio of assets offers a higher expected return with the same or lower risk or lower risk with the same or higher expected return.

Capital Asset Pricing Model

History of CAPM

The CAPM is an important area of finance .William Sharpe, an economist and Nobel Laureate devised CAPM for his 1970 book Portfolio Theory and Capital Markets. He notes that an individual investment contains two kinds of risk:

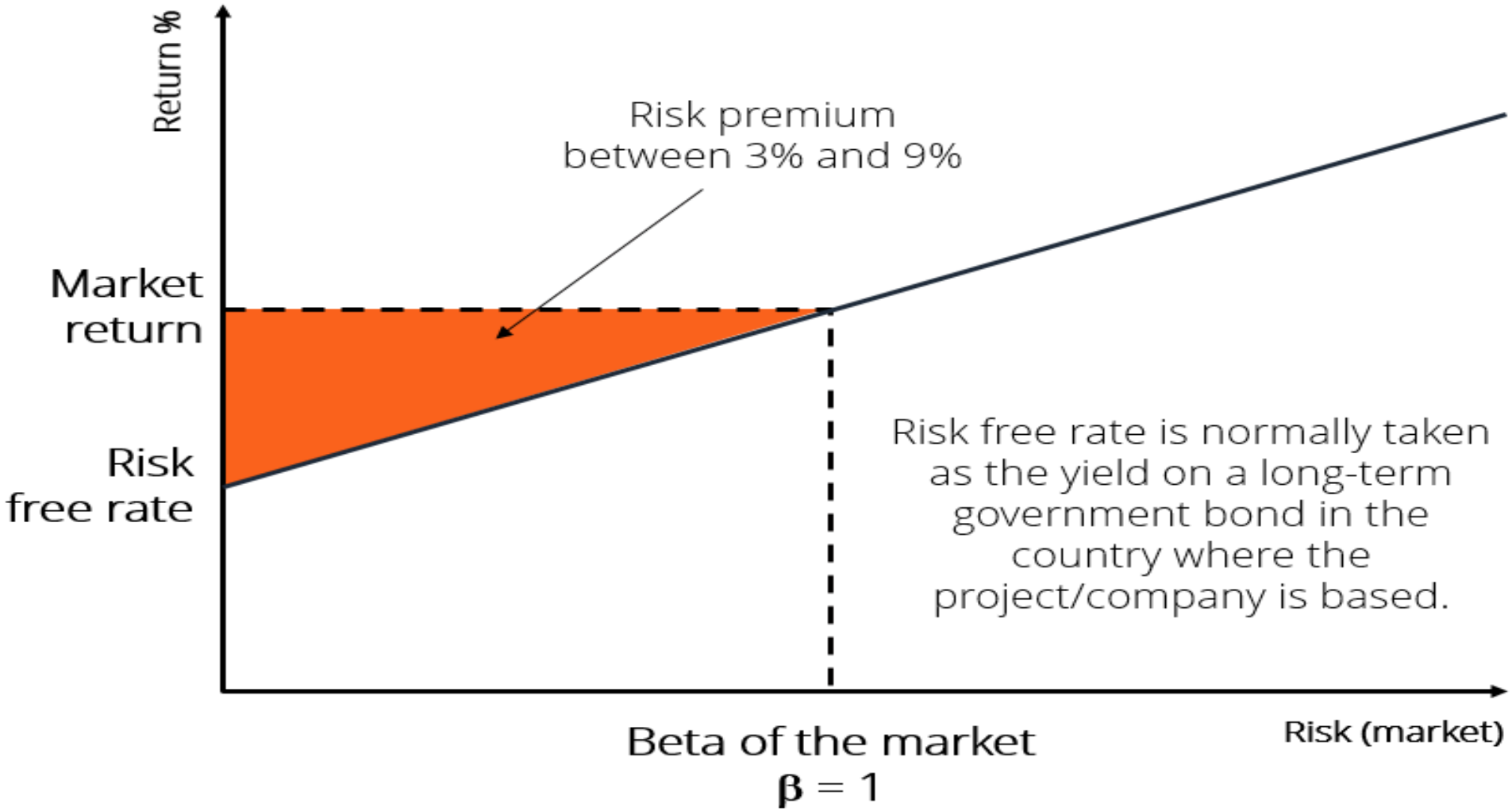
•**Systematic Risk:** In other words, market risk that portfolio diversification can't reduce. Interest rates, recessions, and wars are examples of systematic risks.

•**Unsystematic Risk:** This "specific risk" relates to a specific company or industry. Strikes, mismanagement or shortage of a necessary component in the manufacturing process all qualify as unsystematic risk.

CAPM exists for measuring systematic risk.

The Capital Asset Pricing Model (CAPM) is a model that describes the relationship between the expected return and risk of investing in a security. It shows that the expected return on a security is equal to the risk-free return plus a risk premium.

Capital Asset Pricing Model



CAPM Formula and Calculation

CAPM is calculated according to the following formula:

Where:
Ra = Expected return on a security
Rrf = Risk-free rate
Ba = Beta of the security
Rm = Expected return of the market

The CAPM formula is used for calculating the expected returns of an asset. It is based on the idea of systematic risk (otherwise known as non-diversifiable risk) that investors need to be compensated for in the form of a 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.

Risk-free return

The risk-free return is the return required by investors to compensate them for investing in a risk-free investment. The risk-free return compensates investors for inflation and consumption preference, ie the fact that they are deprived from using their funds while tied up in the investment. The return on treasury bills is often used as a surrogate for the risk-free rate.

Risk premium

Risk simply means that the future actual return may vary from the expected return. If an investor undertakes a risky investment he needs to receive a return greater than the risk-free rate in order to compensate him. The more risky the investment the greater the compensation required. This is not surprising and it is what we would expect from risk- averse investors.

CAPM as an Important tool

The capital asset pricing model is important in the world of financial modeling for a few key reasons. Firstly, by helping investors calculate the expected return on an investment, it helps determine how appropriate a particular investment may be. Investors can use the CAPM for gauging their portfolio’s health and rebalancing, if necessary.

Secondly, it’s a relatively simple formula that’s fairly easy to use. Additionally, the CAPM is an important tool for investors when it comes to accessing both risk and reward. It’s also one of the few formulas that accounts for systematic risk.

Assumptions

The CAPM is often criticised as unrealistic because of the assumptions on which the model is based, so it is important to be aware of these assumptions and the reasons why they are criticised. The assumptions are as follows

- **Investors hold diversified portfolios**

This assumption means that investors will only require a return for the systematic risk of their portfolios, since unsystematic risk has been diversified and can be ignored.

- **Single-period transaction horizon**

A standardised holding period is assumed by the CAPM to make the returns on different securities comparable. A return over six months, for example, cannot be compared to a return over 12 months. A holding period of one year is usually used.

- **Investors can borrow and lend at the risk-free rate of return**

This is an assumption made by portfolio theory, from which the CAPM was developed, and provides a minimum level of return required by investors.

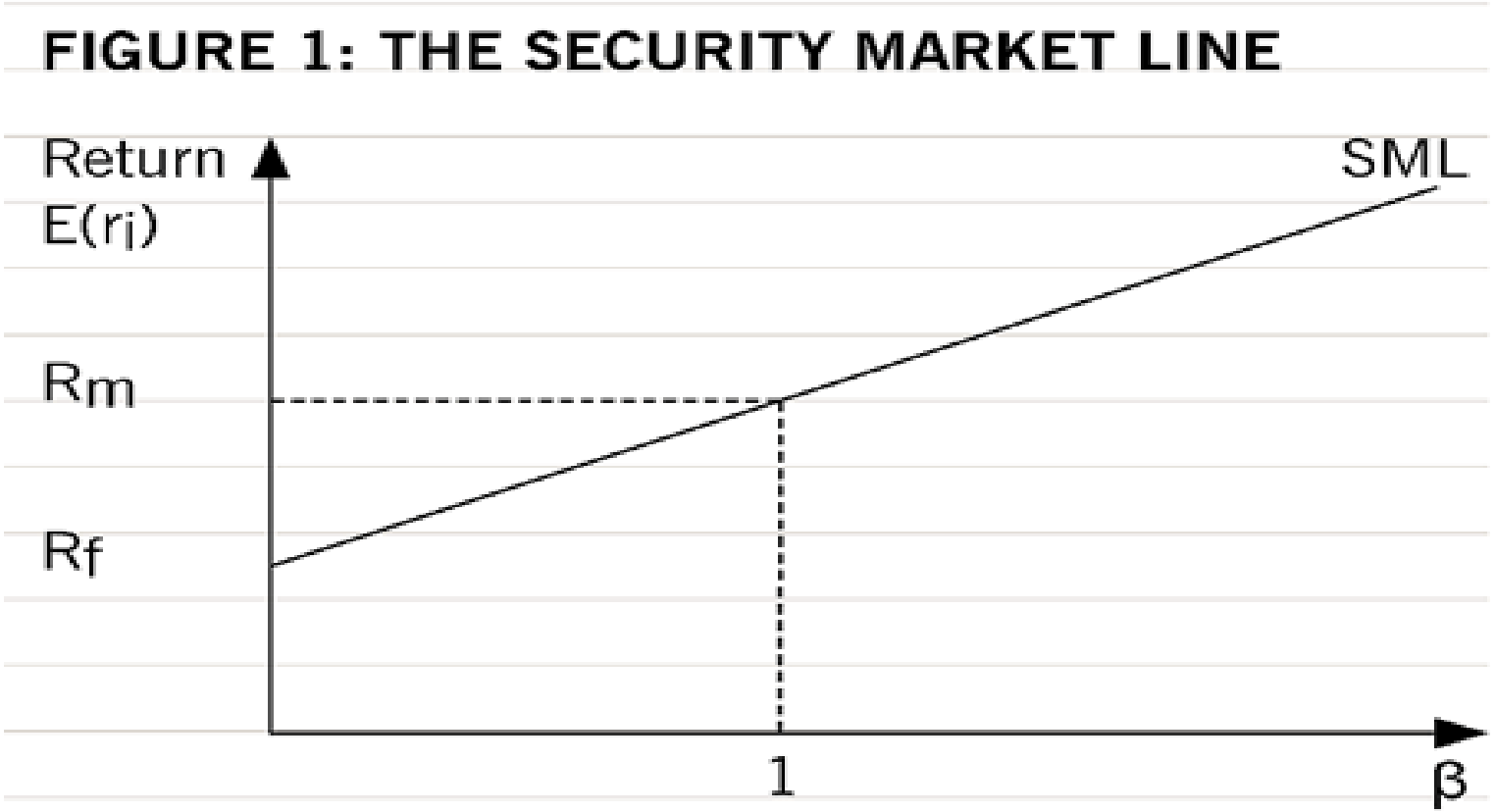
- Perfect capital market

This assumption means that all securities are valued correctly and that their returns will plot on to the SML. A perfect capital market requires the following: that there are no taxes or transaction costs; that perfect information is freely available to all investors who, as a result, have the same expectations; that all investors are risk averse, rational and desire to maximise their own utility; and that there are a large number of buyers and sellers in the market.

The assumption that investors hold diversified portfolios means that all investors want to hold a portfolio that reflects the stock market as a whole. Although it is not possible to own the market portfolio itself, it is quite easy and inexpensive for investors to diversify away specific or unsystematic risk and to construct portfolios that ‘track’ the stock market. Assuming that investors are concerned only with receiving financial compensation for systematic risk seems therefore to be quite reasonable.

Overall, it seems reasonable to conclude that while the assumptions of the CAPM represent an idealised world rather than the real-world, there is a strong possibility, in the real world, of a linear relationship between required return and systematic risk.

SECURITY MARKET LINE



The security market line (SML) is a line drawn on a chart that serves as a graphical representation of the CAPM—which shows different levels of systematic, or market risk, of various marketable securities, plotted against the expected return of the entire market at any given time. 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 concept of beta is central to the CAPM and the SML. The beta of a security is a measure of its systematic risk , which cannot be eliminated by diversification. A beta value of one is considered as the overall market average. A beta value that's greater than one represents a risk level greater than the market average, and a beta value of less than one represents a risk level that is less than the market average.

The formula for plotting the SML is:

- **Required return** = risk-free rate of return + beta (market return - risk-free rate of return)

CAPM, SML, and Valuations

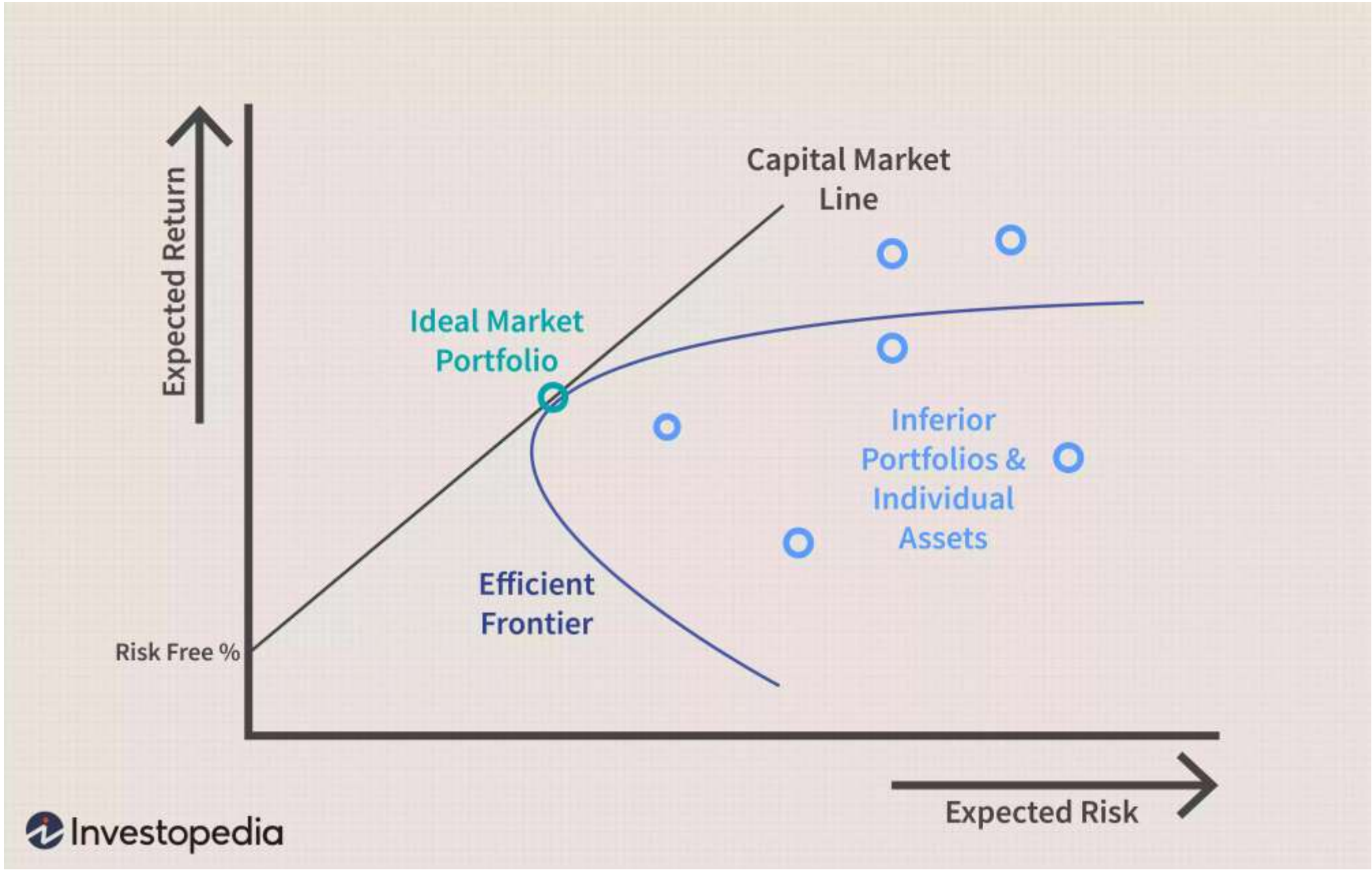
Together, the SML and CAPM formulas are useful in determining if a security being considered for investment offers a reasonable expected return for the amount of risk taken on. If a security's expected return versus its beta is plotted above the security market line, it is considered undervalued, given the risk-return tradeoff. Conversely, if a security's expected return versus its systematic risk is plotted below the SML, it is overvalued because the investor would accept a smaller return for the amount of systematic risk associated.

The SML can be used to compare two similar investment securities that have approximately the same return to determine which of the two securities carries the least amount of inherent risk relative to the expected return. It can also compare securities with equal risk to determine if one offers a higher expected return.

The CAPM and the Efficient Frontier

The capital market line (CML) represents portfolios that optimally combine risk and return. CAPM, depicts the trade-off between risk and return for efficient portfolios. It is a theoretical concept that represents all the portfolios that optimally combine the risk-free rate of return and the market portfolio of risky assets.

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.


Expected Return
Capital Market Line
Ideal Market Portfolio
Inferior Portfolios & Individual Assets
Efficient Frontier
Risk Free %
Expected Risk
Investopedia

The efficient frontier is the set of optimal portfolios that offer the highest expected return for a defined level of risk or the lowest risk for a given level of expected return. Portfolios that lie below the efficient frontier are sub-optimal because they do not provide enough return for the level of risk. Portfolios that cluster to the right of the efficient frontier are sub-optimal because they have a higher level of risk for the defined rate of return.

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 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 CAPM, is the line that connects the risk-free rate of return with the tangency point on the efficient frontier of optimal portfolios that offer the highest expected return for a defined level of risk, or the lowest risk for a given level of expected return. The portfolios with the best trade-off between expected returns and variance (risk) lie on this line. The tangency point is the optimal portfolio of risky assets, known as the market portfolio. Under the assumptions of mean-variance analysis – that investors seek to maximize their expected return for a given amount of variance risk, and that there is a risk-free rate of return – all investors will select portfolios which lie on the CML.

The Capital Market Line and the Security Market Line

The CML is sometimes confused with the security market (SML). The SML is derived from the CML. While the CML shows the rates of return for a specific portfolio, the SML represents the market's risk and return at a given time, and shows the expected returns of individual assets. And while the measure of risk in the CML is the standard deviation of returns (total risk), the risk measure in the SML is systematic risk, or beta. Securities that are fairly priced will plot on the CML and the SML. Securities that plot above the CML or the SML are generating returns that are too high for the given risk and are under-priced. Securities that plot below CML or the SML are generating returns that are too low for the given risk and are overpriced.

LIMITATIONS OF CAPM

- Calculation of beta is a tedious and time consuming process as it requires ample amount of information. Again beta may or may not reflect the future variability of returns and it cannot be expected to be same all the time. It will change with time and situation.
- The specified required rate of return can be considered as only approximation.
- Perfect capital market exists i.e, the market is efficient market.
- Lending and borrowing can take place at risk free rates.
- All investors have the same expectations about return and risk.
- Risk is measured on the basis of historic returns patterns and assumption is that returns pattern will repeat in the future.
- It also assumes that in the financial markets there are no transaction costs, no taxes and no limitations on investments.
- The CAPM also assumes that investors are fully diversified. In practice many investors, particularly small investors, do not hold highly diversified asset portfolio.

The Arbitrage Pricing Theory (APT)

The Arbitrage Pricing Theory (APT)

It is a theory of asset pricing that holds that an asset's returns can be forecasted with the linear relationship of an asset's expected returns and the macroeconomic factors that affect the asset's risk. The theory was created in 1976 by American economist, Stephen Ross. The APT offers analysts and investors a multi-factor pricing model for securities, based on the relationship between a financial asset's expected return and its risks.

The APT aims to pinpoint the fair market price of a security that may be temporarily incorrectly priced. It assumes that market action is less than always perfectly efficient, and therefore occasionally results in assets being mispriced – either overvalued or undervalued – for a brief period of time.

However, market action should eventually correct the situation, moving price back to its fair market value. To an arbitrageur, temporarily mispriced securities represent a short-term opportunity to profit virtually risk-free.

The APT is a more flexible and complex alternative to the Capital Asset Pricing Model (CAPM). The theory provides investors and analysts with the opportunity to customize their research. However, it is more difficult to apply, as it takes a considerable amount of time to determine all the various factors that may influence the price of an asset.

Assumptions in the Arbitrage Pricing Theory

The Arbitrage Pricing Theory operates with a pricing model that factors in many sources of risk and uncertainty. Unlike the Capital Asset Pricing Model (CAPM), which only takes into account the single factor of the risk level of the overall market, the APT model looks at several macroeconomic factors that, according to the theory, determine the risk and return of the specific asset.

These factors provide risk premiums for investors to consider because the factors carry systematic risk that cannot be eliminated by diversifying.

The APT suggests that investors will diversify their portfolios, but that they will also choose their own individual profile of risk and returns based on the premiums and sensitivity of the macroeconomic risk factors. Risk-taking investors will exploit the differences in expected and real returns on the asset by using arbitrage.

Arbitrage in the APT

The APT suggests that the returns on assets follow a linear pattern. An investor can leverage deviations in returns from the linear pattern using the arbitrage strategy. Arbitrage is the practice of the simultaneous purchase and sale of an asset on different exchanges, taking advantage of slight pricing discrepancies to lock in a risk-free profit for the trade. However, the APT's concept of arbitrage is different from the classic meaning of the term. In the APT, arbitrage is not a risk-free operation – but it does offer a high probability of success. What the arbitrage pricing theory offers traders is a model for determining the theoretical fair market value of an asset. Having determined that value, traders then look for slight deviations from the fair market price, and trade accordingly

For example, if the fair market value of stock A is determined, using the APT pricing model, to be $13, but the market price briefly drops to $11, then a trader would buy the stock, based on the belief that further market price action will quickly “correct” the market price back to the $13 a share level.

Mathematical Model of the APT

The Arbitrage Pricing Theory can be expressed as a mathematical model:

$$ER(x) = Rf + \beta_1 RP_1 + \beta_2 RP_2 + \ldots + \beta_n RP_n$$

Where:

- ***ER(x)*** – Expected return on asset
- ***Rf*** – Riskless rate of return
- ***β_n (Beta)*** – The asset's price sensitivity to factor
- ***RP_n*** – The risk premium associated with factor