Risk and Return

"In investing, what is comfortable is rarely profitable." — Robert Arnott

Risk

- The <u>main concern</u> while <u>making investments</u> in any area is risk.

- Risk is defined as <u>variation of actual return</u> from the <u>expected return.</u>

- <u>Any individual</u> while <u>investing</u> his fund tries to <u>estimate the risk</u> associated with his investment and make final decision of <u>investment only</u> if its falls within the level of <u>risk which he can afford</u> to take.

- Risk and expected return of an investment are related. Theoretically, the <u>higher the risk</u>, <u>higher is the expected returned.</u> The higher return is a compensation expected by investors for their willingness to bear the higher risk.

It is therefore important for an individual to estimate the amount of risk being undertaken by him while making investment decisions.

There are two important issues relating to calculation of risk:

A. Factor which leads to creation of risk i.e. which are likely to deviate the actual return from the expected return.

B. Methods of calculating risk

Factors Causing risk

The factors causing risk can be broadly divided in two parts:

A. Systematic Risk

B. Unsystematic Risk

Systematic Risk : It arises due to factors like economic, sociological, political etc. which have bearing on the entire market. This is also called uncontrollable or non-diversifiable risk.

Market risk

Interest rate Risk

Purchasing power Risk

Exchange rate Risk

Market risk

- Market risk is caused by the herd mentality of investors, i.e. the tendency of investors to follow the direction of the market. Hence, market risk is the tendency of security prices to move together. If the market is declining, then even the share prices of good-performing companies fall.

- Market risk constitutes almost two-thirds of total systematic risk. Therefore, sometimes the systematic risk is also referred to as market risk. Market price changes are the most prominent source of risk in securities.

Interest rate risk

- Interest rate risk arises due to changes in market interest rates. In the stock market, this primarily affects fixed income securities because bond prices are inversely related to the market interest rate.

- In fact, interest rate risks include two opposite components: Price Risk and Reinvestment Risk. Both of these risks work in opposite directions. Price risk is associated with changes in the price of a security due to changes in interest rate.

- Reinvestment risk is associated with reinvesting interest/ dividend income. If price risk is negative (i.e., fall in price), reinvestment risk would be positive (i.e., increase in earnings on reinvested money). Interest rate changes are the main source of risk for fixed income securities such as bonds and debentures.

Purchasing Power Risk (or Inflation Risk)

- Purchasing power risk arises due to inflation. Inflation is the persistent and sustained increase in the general price level. Inflation erodes the purchasing power of money.

- Therefore, if an investor's income does not increase in times of rising inflation, then the investor is actually getting lower income in real terms.

- Fixed income securities are subject to a high level of purchasing power risk because income from such securities is fixed in nominal terms.

- It is often said that equity shares are good hedges against inflation and hence subject to lower purchasing power risk.

Exchange Rate Risk

- In a globalized economy, most companies have exposure to foreign currency.

- Exchange rate risk is the uncertainty associated with changes in the value of foreign currencies.

- Therefore, this type of risk affects only the securities of companies with foreign exchange transactions or exposures such as export companies, MNCs, or companies that use imported raw materials or products.

Unsystematic Risk

- Unsystematic risk is the <u>risk that</u> is <u>unique to a specific</u> <u>company</u> or <u>industry</u>.

- It's <u>also known</u> as <u>nonsystematic risk</u>, <u>specific risk</u>, <u>diversifiable risk</u>, or <u>residual risk</u>.

- It arises due to <u>factors peculiar to an given firms</u> such as <u>labour strike</u>, change in <u>management</u>, <u>change in demand of</u> product etc.

- This is <u>also known as Controllable</u> and <u>diversifiable risk</u>.

- There are two kinds of risk which are normally covered under unsystematic Risk :

- Business Risk

- Financial Risk

Business Risk

- Both internal and external issues may cause business risk.

- Internal risks are tied to operational efficiencies, such as management failing to take out a patent to protect a new product would be an internal risk, as it may result in the loss of competitive advantage.

- The Food and Drug Administration (FDA) banning a specific drug that a company sells is an example of external business risk.

Financial Risk

- Financial risk relates to the capital structure of a company.

- A company needs to have an optimal level of debt and equity to continue to grow and meet its financial obligations.

- A weak capital structure may lead to inconsistent earnings and cash flow that could prevent a company from trading.

Return

- Return can be defined as the actual income from a project as well as appreciation in the value of capital.

- Thus, there are two components in return—the basic component or the periodic cash flows from the investment, either in the form of interest or dividends; and the change in the price of the asset, commonly called as the capital gain or loss.

- The term yield is often used in connection to return, which refers to the income component in relation to some price for the asset.

- The total return of an asset for the holding period relates to all the cash flows received by an investor during any designated time period to the amount of money invested in the asset.

Calculation of risk

Example:-1 Consider a company ABC Ltd. Having record of following dividend and average price per share during last six years:

Year	Average Market Price (Rs.)	Dividend per Share (Rs.)
1	35	5
2	42	5
3	49	10
4	55	12
5	52	15
6	60	12

Find Return and Risk associated with the share of the company.

Solution:- Calculation of Return

Year	Average market price	Dividend per share	Capital yield %	Dividend yield %	Total return for a year %
1	35	5	---	---	--- captial yeild+dividend yeild]
2	42	5	20.00	14.29	34.29
3	49	10	16.67	23.81	40.48
4	55	12	12.24	24.49	36.73
5	52	15	-5.45	27.27	21.82
6	60	12	15.38	23.08	38.46
	Sum of the Returns (Year Wise) for given Period				171.78

Average Return $(\bar{R}) = \dfrac{171.78}{5} = 34.36\%$

Solution: **Calculation of Risk**

Year	Total Return (R) %	Deviation of R from Average Return % (R-$\overline{R}$)	Square of Deviation
1	34.29	-0.07	
2	40.48	6.12	3
3	36.73	2.37	
4	21.82	-12.54	1
5	38.46	4.1	

$$\sum (R-R)^2 = 217.1378$$

$$(\sigma)^2 = \frac{\Sigma(R-\overline{R})^2}{N} = 43.42756$$

σ = 6.589959

Standard deviation looks at how spread out a group of numbers is from the mean by looking at the square root of variance, while variance measures the average degree to which each point differs from the mean – average of all data.

Standard deviation is much easier to interpret as it is in the same unit of measurement as that of original data. In case of variance the unit of measurement changes due to squaring, which get restored to the original unit while taking square root of the variance.

Computation of Risk: By Co-efficient of Variation

The concept of **standard deviation** is useful measure of Risk in situation where the **two investment alternatives** are providing **equal Return for a given level of Risk**.

Similarly , when Return are same, one should choose the security with lower level of Standard Deviation (Risk).

But in the situation where the two alternatives gives different return, then it is advisable to use **co-efficient of variation**, which is given as:

$$\text{Co-efficient (C.V.)} = \frac{Standard\ Deviation}{Expected\ Return} = \frac{\sigma}{E(R)}$$

- In Finance, Co-efficient of Variation allows investors to determine how much volatility or risk is assumed in comparison to the amount of return expected from the investment. Ideally, if the co-efficient of variation result in a lower ratio of the standard deviation to mean return, then there is better risk return trade-off.

- If the expected return or denominator is zero or negative, co-efficient of variation could be misleading.

Calculation of risk: By coefficient of variation

Example:-2 There are two alternatives A and B

	Security A	Security B
Expected Return E (R)	20%	20%
Standard Deviation	15%	13%

offering same Return say 20% But A is having Standard Deviation of 15% and B is having Standard Deviation of 13%.

Then, B is considered superior than A as it is inherited with low risk than A for a given level of Return.

Calculation of risk: By coefficient of variation

Example:-2 There are two alternatives A and B. However, the appraisal technique would be different if A is offering rate of Return of 20% and B is offering rate of Return of 17%.

In this case, since the expected rate of return for the two proposal are different therefore one cannot make correct decision simply by referring to Standard Deviation of the two proposal.

In this case, one should calculate coefficient of variation for the two proposal as shown below:

	Security A	Security B
Expected Return E(R) Standard Deviation	20% 15%	17% 13%
Co-efficient of Variation	75	76.47

Now, it is observed that the risk, measured by coefficient of variation, is higher in case of proposal B. therefore, a risk averse investor should opt security A for investment.

Expected Return

The Expected rate of Return is the weighted average of all possible returns multiplied by their respective probabilities.

$$E(R) = \sum_{i=1}^{n} p_i R_i$$

Where E(R) is the expected return,

R_i is the return for the ith possible outcome, p_i is the probability associated with R_i and n is the number of possible outcomes.

Therefore, it can be said that E(R) is the weighted average of all possible outcomes- each outcomes is weighted by the probability associated with it.

Computation of Risk from Expected Return

The variance of probability distributions is the sum of the square of deviations of actual return from the expected return, weighted by the associated probabilities. In symbols:

$$\sigma^2 = \sum_{i=1}^{n} pi(Ri - E(R))^2$$

Where, σ^2 is the variance, Ri is the return for the ith possible outcome, pi is the probability associated with ith possible outcome and E(R) is the expected return.

Calculation of risk: from expected return

Example:-3 Consider the following return under five year different situations and the probability of occurrence of situations is also given for the corresponding return.

Situations	Return (R) %	Probability (P)	PiRi	Deviation R-E(R)	$(R-E(R))^2$	$P \cdot (R-E(R))^2$
1	22	0.15	3.3	-3.6	12.96	1.94
2	26	0.20	5.2	0.4	0.16	0.03
3	24	0.10	2.4	-1.6	2.56	0.25
4	30	0.25	7.5	4.4	19.36	4.84
5	24	0.30	7.2	-1.6	2.56	0.76
		E(R) =	25.6	Variance=7.82	S.D = 2.79	

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

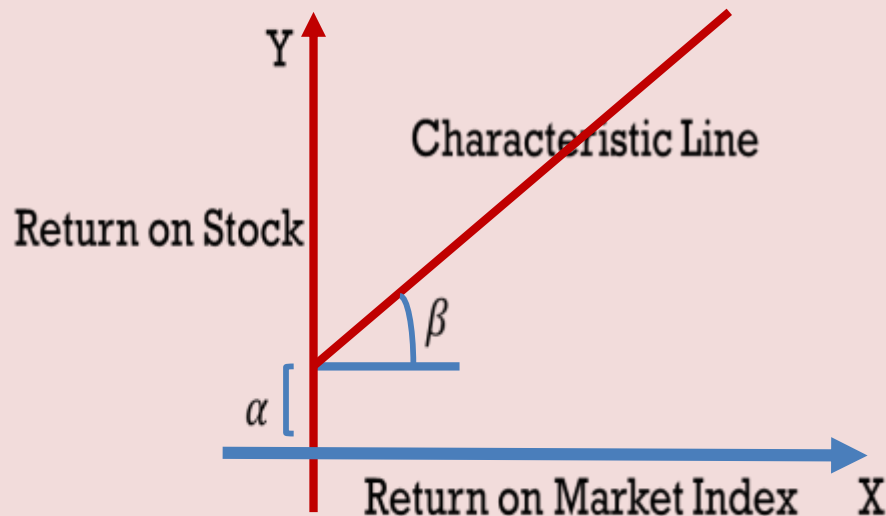$$\text{Variance } (\sigma)^2 = \sum Pi(R - E(R))^2 = 8$$

Method of bifurcating total risk: Systematic and unsystematic

As we already discussed , the total Risk associated with any security comprises of two parts namely systematic and unsystematic Risk, therefore, the analysis are often interested in bifurcating the total Risk into these parts before proceeding for making investment decisions.

In order to bifurcate the total Risk into these parts, one can make use of the characteristic Regression line (CRL). It is a simple regression model which develops relationship between return of a given security against return of the market index. The model is

$$Ri = \alpha + \beta \; X \; Rm$$

Here, α $(intercept \; on \; Y - axis)$ denotes unsystematic Risk and β denotes systematic Risk (slop of the straight line) as shown below
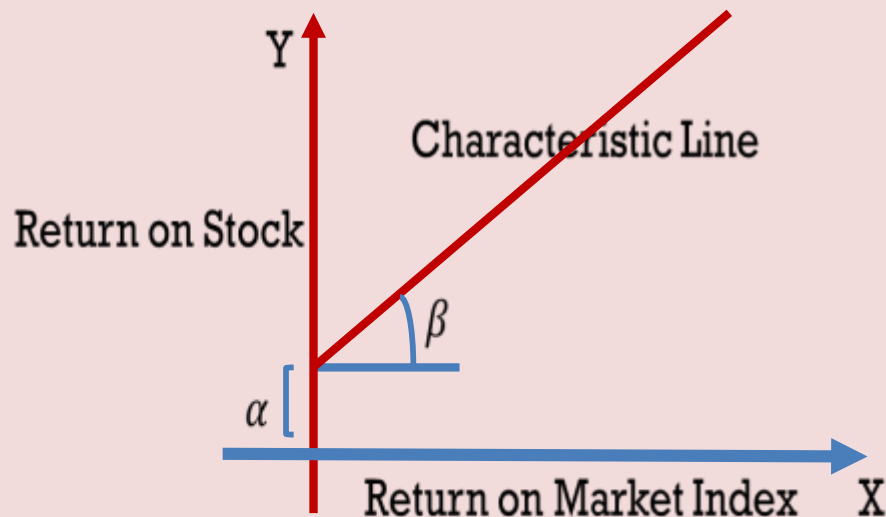
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Measurement of Beta

Characteristic line is used for bifurcating total Risk into and unsystematic risk of the stocks. As beta of the stock volatility of the stock relative to the movement of the also be computed using the following formula:

$$\text{Beta of Stock} = \frac{\{Covarince\ (\ Stock, Market)\}}{Variance\ of\ Market}$$

$$\text{Beta of Stock} = \frac{\{Covarince\ (\ S, M)\}}{(\sigma m)^{\ 2}}$$

Covariance =

$$\frac{\sum(Dev\ from\ average\ return\ in\ stock\ X\ Dev\ from\ average\ return\ in\ market)}{No\ of\ observations}$$

Variance of Market = $\dfrac{\sum(Dev\ from\ average\ return\ in\ market)^2}{No\ of\ observations}$

$$\alpha = \overline{y} - \beta\ \overline{X}$$

Significance of α and β of stocks

A stock with **higher positive α is preferable** over stock with low positive α. A high positive value implies that the stock would give return if there no return or Zero return on the market index. Stock with negative a shall be avoided.

The β value signifies movement of the stock vis-à-vis movement of the market.

Positive β indicates that the stock will in the same direction in which the market index will move. Negative β implies that the stock will move in a direction opposite to the direction of the market. A **high β indicates that the movement in the stock would be higher relative to the market index.**

For example, if the β is =2, then chance in the market on either side would result in 2% chance in the value of the stock. Thus, β **of the stock helps in the process of portfolio churning, i.e. movement of funds from high β to** low β stocks or vice versa.

When the market index is at the support level, the investment advisors prefer to make investment in high β stocks to gain from the upward movement of the market index.

Similarly, when the market index is at the resistance level and likely to move down, investment advisors to make investment in low β **stock so that do not suffer much erosion of their wealth due to any downward movement of the market index.**

Example:-4 consider the following data relating to return on stock and market index: Compute the beta of the stock.

Period	Return on Stock %	Return on Market %
1	10	15
2	18	12
3	14	18
4	20	16
5	11	19

Solution:-

riod	Return on Stock %	Return on Market %	Deviation of Stock Dvs=(Rs-$\overline{Rs}$)	Deviation of Stock Dvm=(Rm-$\overline{Rm}$)	Dvs X Dvm	DVM
1	10	15	-4.6	-1	4.6	1
2	18	12	3.4	-4	-13.6	16
3	14	18	-0.6	2	-1.2	4
4	20	16	5.4	0	0	0
5	11	19	-3.6	3	-10.8	9
otal	73	80			-21	30
erage	14.60	16			-4.2	6

Covariance =

$$\frac{\sum(Dev\ from\ average\ return\ in\ stock\ X\ Dev\ from\ average\ retu}{No\ of\ observations}$$

Covariance = $\dfrac{-21}{5}$ = - 4.2

Variance of Market = $\dfrac{\sum(Dev\ from\ average\ return\ in\ market}{No\ of\ observations}$

Variance of Market = $\dfrac{30}{5}$ = 6

Beta of Stock = $\dfrac{\{Covarince\ (\ Stock, Market)\}}{Variance\ of\ Market}$

$= \dfrac{-4.2}{6}$ = -0.7