UNIT 3 RISK AND RETURN

3.1 INTRODUCTION

Return expresses the amount which an investor actually earned on an investment during a certain period. Return includes the interest, dividend and capital gains; while risk represents the uncertainty associated with a particular task. In financial terms, risk is the chance or probability that a certain investment may or may not deliver the actual/expected returns. Investors make investment with the objective of earning some tangible benefit. This benefit in financial terminology is termed as return and is a reward for taking a specified amount of risk.

Risk is defined as the possibility of the actual return being different from the expected return on an investment over the period of investment. Low risk leads to low returns. For instance, in case of government securities, while the rate of return is low, the risk of defaulting is also low. High risks lead to higher potential returns, but may also lead to higher losses. Long-term returns on stocks are much higher than the returns on Government securities, but the risk of losing money is also higher.

The risk and return trade off says that the potential return rises with an increase in risk. It is important for an investor to decide on a balance between the desire for the lowest possible risk and highest possible return.

Rate of return on an investment can be calculated using the following formula-

Return = (Amount received - Amount invested) / Amount invested

The functions of Financial Management involves acquiring funds for meeting short term and long term requirements of the firm, deployment of funds, control over the use of funds and to trade-off between risk and return.

3.2 LEARNING OBJECTIVES

After reading this unit, you should be able to;

- Measure the risk and return of a single asset.
- Measure the risk and return of a portfolio.
- Distinguish between systematic and unsystematic risk.
- Estimate the beta of a security.

3.3 RISK AND RETURN: CONCEPT AND MEANING

Return - Return is nothing but the reward for undertaking investment. Assessment of historical returns is must to know the performance of the fund manager. This also helps as an important input to estimate future returns.

It has two components.

Current return – It is the periodic cash flow in the form of interest or dividend

Capital return --- It represents change in the price of asset.

Thus Total Return = Current Return + Capital Return

The current return can be zero or positive, whereas capital return can be zero, positive or negative.

Risk - What is this?

Consider the two cases.

Mr Ramesh has put his money in RBI bond where he is going to get 12% p.a.. He is really happy with the rate of return. Will he have sleepless nights, if the economy goes into recession? Of course no.

Mr. Ramesh is very bullish with the stock market and invests money into equity diversified fund with the expectation that he will get 12% return. Will he have sleepless nights if economy goes into deep recession, and now he feels that he may get negative returns of say 5-7%? Of course yes

What is the reason behind this?

In the second situation, he has a fear, which is the result of huge difference in his expected return and the actual return, which he may get. This difference itself is the risk that he bears. Does he face this kind of difference in the first situation? No. So there is no risk.

Thus risk is nothing but the possibility that actual outcome of investment will differ from expected outcome of investment.

Risk in Investment

Risk can be broadly classified in to two types.

- Systematic Risk
- Non Systematic Risk

1) Systematic risk - The risk inherent to the entire market or entire market segments is known as systematic risk. This is also known as "un-diversifiable risk" or "market risk". Interest rates, inflation, economic policies, recession, wars etc all represent sources of systematic risk because they affect the entire market and cannot be avoided through diversification. This risk can be mitigated through hedging. Systematic risk is measured by Beta coefficient. Systematic risk covers:

- Market risk
- Interest rate risk
- Purchasing Power risk
- Political risk

Market Risk - Market risk is referred to variation in securities prices due to changes in investor's attitudes and expectations. Investors reaction on the occurring of tangible and intangible events in the main cause of affecting "market risk". The tangible events have a 'real' basis but the intangible events are based on 'psychological' basis or these are there reactions on some expectations or realities. Market risk triggers because of the real events such as political, social and economic reasons. The initial decline or rise in the share prices create an emotional instability among the investors and cause a fear of loss or create an undue confidence, relating to the possibility of profit. The fear of loss results in the excessive selling of securities and bringing down the prices of shares whereas possibility of gain results in active buying of securities. However, investors are more reactive towards decline in share prices rather than increase in prices. Market risk cannot be eliminated while financial risk can be reduced. Through diversification though market risk can be reduced but it cannot be full eliminated because prices of all securities move together and every equity stock holder will faced the risk of a downwards market.

Investors can try to eliminate the market risk by being conservative in framing their portfolios. They can time their stock purchases and can also choose growth stock as a part of

their portfolio. These methods can to some extent will reduce the risk to some degree but as mentioned earlier, market risk will not be completely eliminated. Market risk includes such factors as business recessions, depressions and long run changes in consumption in the economy.

Interest Rate Risk – Interest rate in the economy generally fluctuates because of the regulatory framework or due to the market forces. If the interest rate rises then it increases the investors' expected rate of return from investment, due to which prevailing share price become unattractive. Another effect of increased expected rate of return is that, low yield debentures or bonds become unattractive at the prevailing price due to which prices of these also come down. So we can say that the interest rate also accounts for a major part of the systematic risk. Recently frequent changes in CRR, Bank rate, repo rate, reverse repo rate by RBI resulted in the change in the expectation of return by investors followed by a frequent change in the share prices on the stock market.

Purchasing Power Risk – Purchasing power risk is also known as inflation risk. The risk arises due to the change in prices of goods and services and technically it covers both inflation and deflation periods. In India purchasing power risk is associated with inflation and rising prices in the economy. Inflation in India has been either "demand pull" or "cost push". In demand pull inflation there is increase in demand for goods but there is no smooth supply and consequently price rises. In cost push inflation the rise in prices of raw material increases the cost of production. The increase in cost of production has shown a rising trend in 'wholesale price index' and 'consumer price index'. A rising trend in price index reflects a price spiral in the economy.

Political Risk – Performance of stock market also depends on a political scenario. Political uncertainty adversely affects the share prices.

So from the above discussion it comes to our knowledge the market interest rates and purchasing power risk are two principal sources of systematic risk in securities. The unsystematic risk will affects the internal environment of a firm or industry. The two kinds of unsystematic risk in business organization are 'business risk' and 'financial risk'. The characteristics of these risks are broadly described.

2) Unsystematic Risk – The risk which is specific to a company or industry is known as unsystematic risk. This risk can be reduced through appropriate diversification. This is also known as "specific risk", "diversifiable risk" or "residual risk". Unsystematic risk covers:

- Business Risk
- Financial Risk

Business Risk – Business risk is associated with risks directly affecting the internal environment of the firm and those of circumstances beyond its control. The former is classified as internal business risk and the latter as external business risk. Within these two broad categories of risk, the firm operates.

Internal business risk can be because of rise and decline of total revenues as indicated in the firm's earnings before interest and taxes. A firm with high fixed cost has large internal risk because the firm find it difficult to reduce its expenses during a sluggish market. Even during the improved market conditions, a firm with high fixed cost would be unable to respond to changes in the economy because it would already be burdened with certain fixed cost factor. As far as external risk are concerned which are beyond the control of the firm are depend upon the external factors such as political policies, monetary policies, demographics factors and economic environment.

Financial Risk - Financial risk is associated with the capital structure of the company. Company can raises funds through equity and through the debt. A company with a high degree of debt in its financial structure has high financial leverage, which has an adverse effect on the earnings of the company. Hence companies with high financial leverage are considered as high risky and vice versa.

So the total risk of an investment consists of two components: diversifiable and non diversifiable risk. Diversifiable or unsystematic risk is that portion of an investment risk that can be eliminated by holding enough securities. Unsystematic risk is a unique to a firm or industry and is caused by factors like labour strike, irregular disorganized management policies and consumer preferences. Non diversifiable or systematic risk is external to an industry and business and is attributed to the factors, such as war, inflation and political events etc. The effect of these factors is to put pressure on all securities in such a way that the prices of the securities will move in the same direction. The relationship between total risk, diversifiable risk and nondiversifiable risk is given by the equation:

Total risk = Non systematic risk + Systematic risk

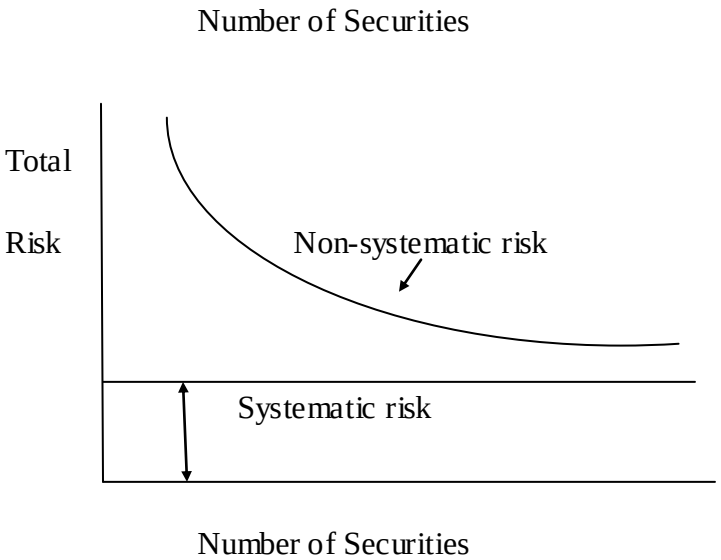
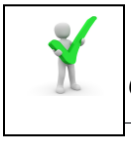


Fig – 3.1 Graph showing effect of diversification on risk



Check Your Progress-A

Q1. What is risk?

Q2. Distinguish between systematic and unsystematic risk?

Q3. What is financial risk?

Q4. In what way can the relationship of risk and return be established?

3.4 QUANTIFICATION OF RETURNS AND RISK

3.4.1 CALCULATION OF HISTORICAL RETURNS

Single period return : Let's say Shyam invests Rs100 (P0) in Chennai Petro and one year later, he sells it for Rs110 (P1).

A) What is the rate of return on investment?

B) If company pays 2 Rs. dividend (D1) during this period, what is the return on investment?

We calculate it by using the following formula:

Rate of Return = ((P1- P0) / P0) × 100

Therefore,

((110 - 100) / 100) × 100 = 10%

A) The rate of return is 10%.

B) The rate of return = ((P1+D1- P0) / P0) × 100 = ((110+2 - 100) / 100) × 100 = 12%

There are two ways to measure multiple period returns

- Average annual arithmetic return
- Average annual geometric return

A simple example below will show what these two yardsticks measure.

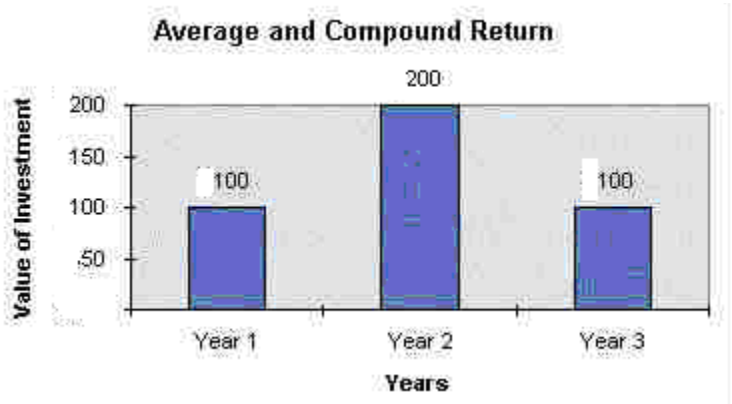


Fig 3.2 Average and Compound Returns

Year1 indicates investment on 31st Dec, 2015, year 2 indicates 31st Dec 16 and so on.

Just consider that you have initially invested Rs100 in the Chennai Petro. One year later, your investment grows to Rs 200 in value. The year after that, the investment drops back to Rs.100.

The Average annual arithmetic return:

((The value of investment on 31st Dec.16- Capital) / Capital) × 100% = Rate of Return

((200 - 100) / 100) × 100 = 100%

The rate of return after the second year is

((100 - 200) / 200) × 100% = -50%

So, the Average annual arithmetic return = (Rate of Return for Year 2015-16 + Rate of Return for Year 2016-17) / 2 = (100% + (-50%)) / 2 = 25%

Average annual geometric return:

Compound return (geometric mean) = The value of investment /Capital) ^ (1 / n) - 1

Where n = number of years.

So (100 / 100) ^ .5 - 1 = 0%.

Or Simply Square root of 100 /100 - 1 = 0 %

See the difference, the first method gives a return of 25% whereas second one gives the return of 0%. Just think of the investor who has been with the fund house for two years. What has he earned if he sells his investment today, it is 0%.

Innocent investors are trapped by the fund houses through average annual arithmetic return. So investors need to watch out for Geometric return which is mentioned in the form of CAGR.

For example. . Take the following series of returns of last four years for SBI Magnum Tax Gain Scheme: 100%, 50%, 33.33%, -75% The arithmetic mean of this series is simply (100 + 50 + 33.33 -75) / 4 = 27.08%. So far so good, right? Everybody is familiar with the arithmetic mean: it's just the sum of all values in a series divided by the number of values in the series. Problem is, taking a simple average of mutual fund returns will yield incorrect (and artificially high) results.

Say you have invested Rs10,000 in SBI tax gain scheme , which has proceeded to gain 100% It means it will become 20000Rs. Again 50% return means 30000Rs. Again 33.33% return means 40000Rs. And loss of 75% over this means again 10000Rs. It means no returns for last four years.

3.4.2 CALCULATION OF EXPECTED RETURN

When we talk about expectations, we talk about probability. The future or expected return of a security is uncertain, however it is possible to describe the future returns statistically as a probability distribution. The mean of this distribution is the expected return.

Take a very simple example. Suppose we know that a particular security will, over the next year, either:

rise 25%, with a 50% probability that this will happen, or

fall 20% with a 50% probability

Then:

Expected return = (25% ×50%) - (20% ×50%) = 2.5%

3.4.3 COMPUTATION OF HISTORICAL RISK

As it has already been mentioned, risk is nothing but possibility that actual outcome of investment will differ from expected outcome of investment. To estimate this deviation, statistical tools like Variance and standard deviations are used. Variance is the square of standard deviation. So let's see the basic behind usage of standard deviation to measure the risk and also the way to calculate it.

To understand this concept, it is necessary to know about normal distribution of data.

A normal distribution of data means that most of the examples in a set of data are close to the "average," while relatively few examples tend to one extreme or the other.

Let's say you are writing a story about nutrition. You need to look at people's typical daily calorie consumption. Like most data, the numbers for people's typical consumption probably will turn out to be normally distributed. That is, for most people, their consumption will be close to the mean, while fewer people eat a lot more or a lot less than the mean.

If you looked at normally distributed data on a graph, it would look something like this:

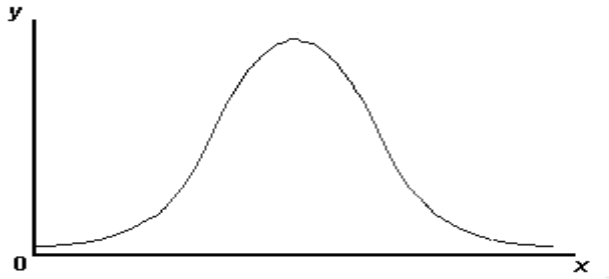


Fig3.3 Normal Distribution

The x-axis (the horizontal one) is the value in question... calories consumed, dollars earned or crimes committed, for example. And the y-axis (the vertical one) is the number of datapoints for each value on the x-axis... in other words, the number of people who eat x calories, the number of households that earn x dollars, or the number of cities with x crimes committed.

Now, not all sets of data will have graphs that look this perfect. Some will have relatively flat curves, others will be pretty steep. Sometimes the mean will lean a little bit to one side or the other. But all normally distributed data will have something like this same "bell curve" shape.

The standard deviation is a statistical tool that tells you how tightly all the various examples are clustered around the mean in a set of data. When the examples are pretty tightly bunched together and the bell-shaped curve is steep, the standard deviation is small. When the

examples are spread apart and the bell curve is relatively flat, that tells you have a relatively large standard deviation.

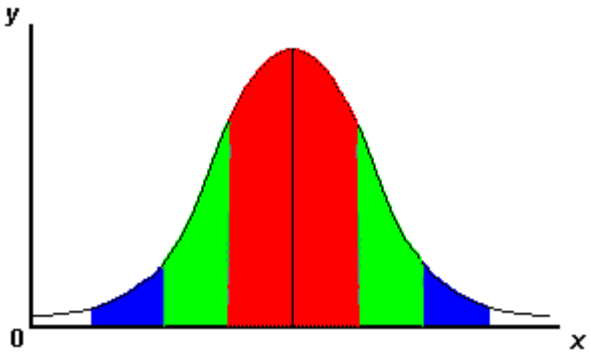


Fig 3.4 Graphical representation of standard deviation.

One standard deviation away from the mean in either direction on the horizontal axis (the red area on the above graph) accounts for somewhere around 68 percent of the people in this group. Two standard deviations away from the mean (the red and green areas) account for roughly 95 percent of the people. And three standard deviations (the red, green and blue areas) account for about 99 percent of the people.

If this curve were flatter and more spread out, the standard deviation would have to be larger in order to account for those 68 percent or so of the people. So that's why the standard deviation can tell you how spread out the examples in a set are from the mean.

Why is this useful? Here's an example: If you are comparing the returns for different periods, the standard deviation will tell you how diverse the returns are. If the rates of returns are very close to the mean the S.D. will be very less and vice versa.

Mr.Kiran wants to invest either in Arvind Mills or SPL Industeries, Arvind Mills has mean returns of 9.5% and S.D. is 1% whereas SPL Industries has mean returns of 9.75% and S.D. is 18%. This information can help the kiran to invest into Arvind Mills even if the reurns are less by 25 basis points.

It is a measure of the dispersion of a set of data from its mean. It simply quantifies how much a series of security's returns varies around their mean, or average returns.

To illustrate this concept, let's review the following examples.

A security that gained 1% each and every month over the past 36 months would have a standard deviation of zero, because its monthly returns didn't change from one month to the next.

A security that lost 1% each and every month would also have a standard deviation of zero, because, again, its returns didn't vary.

A security that gained 5% one month, 25% the next, and -7% the next would have a much higher standard deviation; its returns have been more varied.

Investors like using standard deviation because it provides a precise measure of how varied a security's returns have been over a particular time period in the past. Using the past standard deviation, you can predict the range of returns your security is likely to generate in the future. A large dispersion tells us how much the returns of the fund may deviate from the expected normal returns. Standard deviation is probably used more often than any other measure to gauge a fund's risk.

Quantification of Historical Risk

Step by Step computation of Variance and Standard Deviation for SPL Industries

Step 1 – Calculation of Returns

Date	Price	Returns
Sep-85	5.9375	
Sep-86	10.0625	0.694737
Sep-87	20.8125	1.068323
Sep-88	21.785	0.046727
Sep-89	22.45	0.030526
Sep-90	15.025	-0.33073
Sep-91	24.865	0.654908
Sep-92	23.365	-0.06033
Sep-93	12.615	-0.46009
Sep-94	17.49	0.386445
Sep-95	18.615	0.064322
Sep-96	11.56	-0.379
Sep-97	11.0625	-0.04304
Sep-98	15.3125	0.384181

Sep-99	30.85938	1.015306
Sep-00	59.9375	0.942278
Sep-01	55.51	-0.07387
	Sumof Returns	3.9407
	Average Return	0.246294

Average Return = Sum of Returns/16

Step 2 – Calculation of deviation of actual return from average return and sum of squared deviations of actual returns from expected (arithmetic mean) return,

t	Rt	Rt - E(Rt)	$(Rt - E(Rt))^2$
1	0.694737	0.448443	0.201101
2	1.068323	0.822029	0.675732
3	0.046727	-0.19957	0.039827
4	0.030526	-0.21577	0.046556
5	-0.33073	-0.57703	0.332962
6	0.654908	0.408614	0.166966
7	-0.06033	-0.30662	0.094016
8	-0.46009	-0.70638	0.498978
9	0.386445	0.140151	0.019642

10	0.064322	-0.18197	0.033114
11	-0.379	-0.62529	0.390987
12	-0.04304	-0.28933	0.083712
13	0.384181	0.137887	0.019013
14	1.015306	0.769012	0.59138
15	0.942278	0.695984	0.484394
16	-0.07387	-0.32016	0.102504
Sum of $(Rt - E(Rt))^2$=			3.780884

Measuring Risk:

Risk = Variance (or standard deviation) of historical returns

Variance = Sum of squared deviations of actual returns from expected

(arithmetic mean) return, divided by number of observations -1

So Variance = The sum of squared deviations shown in the last column, divided by the number of observations -1

= 3.780884/15 = .2520

Standard Deviation = Square Root of the Variance

= (0.2520)1/2 = 0.50 means 50%

2) The returns of Varun Shipping for last 6 years have been mentioned below. Calculate Variance and Standard Deviation (Standard format and formulae)

MEASURING HISTORICAL RISK

$$\sigma = \left[\frac{\sum_{t=1}^{n} (R_i - \overline{R})^2}{n-1} \right]^{1/2}$$

PERIOD	RETURN R_i	DEVIATAION $(R_i - \overline{R})$	SQUARE OF DEVIATION $(R_i - \overline{R})^2$
1	15	5	25
2	12	2	4
3	20	10	100
4	-10	-20	400
5	14	4	16
6	9	-1	1
	$\Sigma R_i = 60$		$\Sigma (R_i - \overline{R})^2 = 536$
	$\overline{R} = 10$		

$$\sigma^2 = \left[\frac{\Sigma (R_i - \overline{R})^2}{n-1} \right] = 107.2 \qquad \sigma = [107.2]^{1/2} = 10.4$$

Quantification of Ex-ante (expected) risk

Step by Step computation of Variance and Standard Deviation for HDIL

Probability distribution of HDIL's Expected Returns

Market Scenario	Probability	Return on Investment
Very Bullish	20%	25%
Bullish	40%	15%
Bearish	30%	5%
Very Bearish	10%	0%

Market Scenario	Return on Investment	minus	Return — Expected Rate of Return	equals	answer	squared	times	Probability of the Economic Outcome	equals	Answer
Very	25%	-	12.5%	=	12.5	156.	X	20%	=	31.25

Bullish						25				
Bullish	15%	-	12.5%	=	2.5	6.25	X	40%	=	2.5
Bearish	5%	-	12.5%	=	-7.5	56.25	X	30%	=	16.875
Very Bearish	0%	-	12.5%	=	-12.5	156.25	X	10%	=	15.625
								Total	=	66.25

So the total is 66.25. This is called the Variance.

The square root of 66.25 = 8.139

So the Standard Deviation is 8.139

2. Calculation of Variance and Standard Deviation (Standard format and formulae) of Bharat Foods Ltd.

MEASURING EXPECTED (EX ANTE) RETURN AND RISK

EXPECTED RATE OF RETURN

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

STANDARD DEVIATION OF RETURN

$$\sigma = [\Sigma p_i (R_i - E(R))^2]$$

Bharat Foods Stock

i. State of the Economy	p_i	R_i	p_iR_i	R_i-$E(R)$	$(R_i$-$E(R))^2$	$p_i(R_i$-$E(R))^2$
1. Boom	0.30	16	4.8	4.5	20.25	6.075
2. Normal	0.50	11	5.5	-0.5	0.25	0.125
3. Recession	0.20	6	1.2	-5.5	30.25	6.050
	$E(R) = \Sigma p_iR_i =$		11.5		$\Sigma p_i(R_i - E(R))^2$	=12.25

$$\sigma = [\Sigma p_i(R_i - E(R))^2]^{1/2} = (12.25)^{1/2} = 3.5\%$$

3.5 COMPUTATION OF PORTFOLIO RETURNS AND RISK

3.5.1 CALCULATING THE EXPECTED RETURN OF A PORTFOLIO

The expected return on a portfolio is the weighted average of the expected returns on the securities included in that portfolio;

What is the weight of a security in a portfolio? It is the percentage of wealth invested in that security

The formula to compute the expected return on a portfolio of N securities is

$$\bar{r}_p = \sum_{i=1}^{N} X_i \bar{r}_i ,$$

Where

X_i = is the weight of security i; and

$\bar{r}_i$ = is the expected return on security i.

Example

On January 25, 1999, Mr. Ramesh bought the following stocks:

Quantity	Price	Stock
200	171	RCOM
500	185.6	DLF
1,000	62.5	Hindalco

Mr. Ramesh expects to earn the following (annual) returns on the stocks: 20% on RCOM, 12% on DLF, and 15% on Hindalco. What is the expected return on your portfolio?

First, we need to compute the weight of each security.

The total wealth invested is equal to

TI =(171*200) + (185.60*500)+(62.50*1,000)

=34,200+92,800+62,500

Hence Weights of these securities will be

X1=18.05%[=34,200/189,500]

X2=48.97%[= 92,800 /189,500];

X3=32.98%[= 62,500 /189,500].

Using the formula

$$\bar{r}_p = \sum_{i=1}^{3} X_i \bar{r}_i ,$$

The expected return on your portfolio is 14.43%

[=0.1805*20%+0.4897*12%+0.3298*15%].

3.5.2 CALCULATION OF RISK OF THE PORTFOLIO

Before we discuss the risk of a portfolio it is must to know the Covariance and correlation coefficient

The Covariance between Two Rates of Return

The covariance is a (statistical) measure of how two random variables (in this case, the returns of two securities) "move together;"

A positive covariance between the returns of two securities indicates that the returns of the two securities tend to move in the same direction, that is, better-than-expected returns for one security are likely to occur when better-than-expected returns occur for the other security;

A negative covariance between the returns of two securities indicates that the returns of the two securities tend to move in opposite directions, that is, better-than-expected returns for one security are likely to occur when worse-than-expected returns occur for the other security;

A relatively small or zero covariance between the returns of two securities indicates that there is little or no relationship between the returns of the two securities;

We denote the covariance between the return of security i and the return of security j by (the Greek letter sigma);

Note that ;You may use the Excel function "COVAR" to compute the covariance between the returns of two securities.

The Correlation Coefficient

The correlation coefficient is a statistical measure closely related with the covariance; The interpretation of the correlation coefficient is that of a "normalized covariance;"

We denote the correlation coefficient between the return of security i and the return of security j by (the Greek letter pho);

The relation between covariance and correlation is given by the following equation:

$$\sigma_{ij}=\rho_{ij}\sigma_i\sigma_j$$

The correlation coefficient between the return of security i and the return of security j lies between -1 and 1;

If the correlation coefficient between the returns of two securities is positive, then the returns of the two securities tend to move in the same direction, that is, better-than-expected returns for one security are likely to occur when better-than-expected returns occur for the other security;

If it is negative, then the returns of the two securities tend to move in opposite directions, that is, better-than-expected returns for one security are likely to occur when worse-than-expected returns occur for the other security;

If it is close to 0, then there is little or no relationship between the returns of the two securities;

You may use the Excel function "CORREL" to compute the correlation coefficient between the returns of two securities

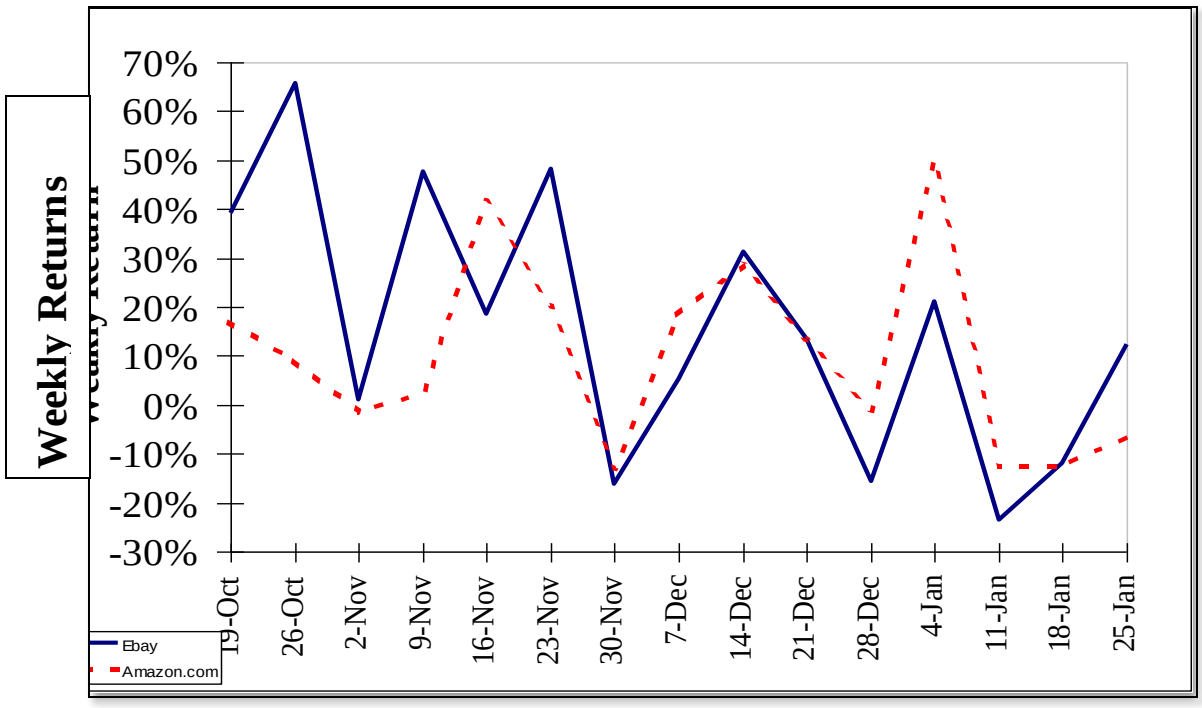


Fig 3.5 (a) Weekly Returns

Weekly returns on National Fertilisers and Chambal Fertilisers in the period October 98-January 99. The Correlation Coefficient between the weekly returns of these securities turned out to be 0.48;

The formula for CAPM is Ks = Krf + B (Km - Krf).

Weekly returns of National Fertilisers and Chambal Fertilisers in the period October 98-January 99. The Correlation Coefficient between the weekly returns of these securities turned out to be 0.48;

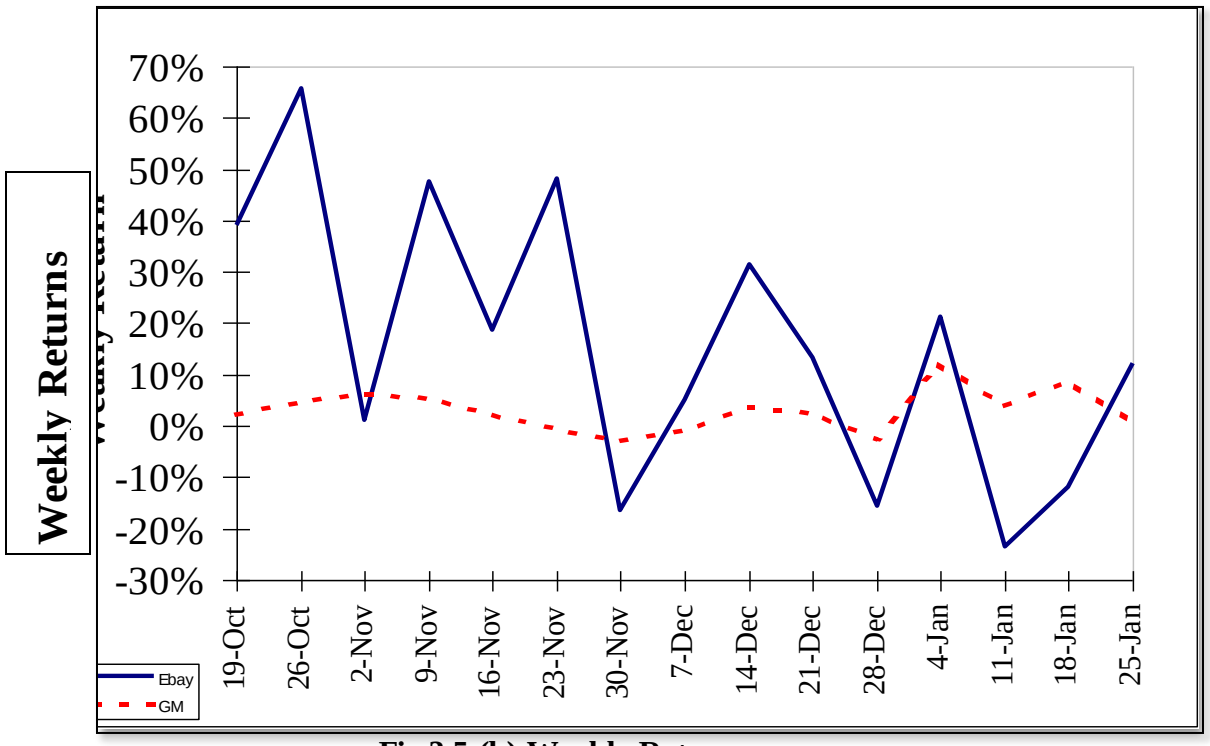


Fig 3.5 (b) Weekly Returns

Weekly returns of National Fertilisers and Uco Bank in the period October 98-January 99. The Correlation Coefficient between the weekly returns of these securities turned out to be .16

Calculation of Standard Deviation of a Portfolio (Risk of Portfolio):

The formula to compute the standard deviation of a portfolio of N securities is

$$\sigma p = [\sum \sum wi\ wj\ \rho ij\ \sigma i\ \sigma j\ ]\ ½$$

Ex. – Risk of a portfolio consisting of 2 securities

$\sigma p = [w12\ \sigma 12 + w22\ \sigma 22 + 2w1w2\ \rho 12\ \sigma 1\ \sigma 2]½$

Example : $w1 = 0.6$, $w2 = 0.4$,

$\sigma 1 = 10\%$, $\sigma 2 = 16\%$

$\rho 12 = 0.5$

$\sigma p = [0.62 \times 102 + 0.42 \times 162 + 2 \times 0.6 \times 0.4 \times 0.5 \times 10 \times 16]½$

$= 10.7\%$

The average standard deviation of two securities is 13, which is less than standard deviation of the portfolio, which is 10. Thus diversification reduces risk.

Ex. -- Risk of a portfolio consisting of n securities

$\sigma p = [\ \sum \sum wi\ wj\ \rho ij\ \sigma i\ \sigma j\ ]\ ½$

$w1 = 0.5$, $w2 = 0.3$, and $w3 = 0.2$

$\sigma 1 = 10\%$, $\sigma 2 = 15\%$, $\sigma 3 = 20\%$

$\rho 12 = 0.3$, $\rho 13 = 0.5$, $\rho 23 = 0.6$

$\sigma p = [w12\ \sigma 12 + w22\ \sigma 22 + w32\ \sigma 32 + 2\ w1\ w2\ \rho 12\ \sigma 1\ \sigma 2$

$+ 2w2\ w3\ \rho 13\ \sigma 1\ \sigma 3 + 2w2\ w3\ \rho 23 \sigma 2\ \sigma 3]\ ½$

$= [0.52 \times 102 + 0.32 \times 152 + 0.22 \times 202$

$+ 2 \times 0.5 \times 0.3 \times 0.3 \times 10 \times 15$

$+ 2 \times 0.5 \times 0.2 \times 05 \times 10 \times 20$

$+ 2 \times 0.3 \times 0.2 \times 0.6 \times 15 \times 20]\ ½$

$= 10.79\%$

3.6 MEASUREMENT OF SYSTEMATIC RISK - BETA

CALCULATION OF BETA

Beta– Beta is a measure of any individual stock's risk (or movement) relative to the overall stock market risk (or movement). It's sometimes referred to as financial elasticity. It's just one of several values that stock analysts use to get a better feel for a stock's risk profile. Beta values are fairly easy to interpret. If the stock's price experiences movements that are greater or more volatile than the stock market, then the beta value will be greater than 1. If a stock's price movements, or swings, are less than those of the market then the beta value will be less than 1. Since increased volatility of stock price means more risk to the investor, we'd also expect greater returns from stocks with betas over 1. The reverse is true of a stock's beta is less than 1 - we'd expect less volatility, lower risk, and therefore lower overall returns. Although beta allows you to understand if the price of that security has been more or less volatile than the market itself - and that's certainly a good thing to understand about a stock one is planning to buy.

Calculation of Beta value of a Security

Period	Return on stock A, R_A	Return on market portfolio, R_M	Deviation of return on stock A from its mean $(R_A - \overline{R_A})$	Deviation of return on market portfolio from its mean $(R_M - \overline{R_M})$	Product of the deviation, $(R_A - \overline{R_A})^*$ $(R_M - \overline{R_M})$	Square of the deviation of return on market portfolio from its mean $(R_M - \overline{R_M})^2$
1	10	12	0	3	0	9
2	15	14	5	5	25	25
3	18	13	8	4	32	16
4	14	10	4	1	4	1

5	**16**	**9**	**6**	**0**	**0**	**0**
6	**16**	**13**	**6**	**4**	**24**	**16**
7	**18**	**14**	**8**	**5**	**40**	**25**
8	**4**	**7**	**-6**	**-2**	**12**	**4**
9	**- 9**	**1**	**-19**	**-8**	**152**	**64**
10	**14**	**12**	**4**	**3**	**12**	**9**
11	**15**	**-11**	**5**	**-20**	**-100**	**400**
12	**14**	**16**	**4**	**7**	**28**	**49**
13	**6**	**8**	**-4**	**-1**	**4**	**1**
14	**7**	**7**	**-3**	**-2**	**6**	**4**
15	**- 8**	**10**	**-18**	**1**	**-18**	**1**

$\sum R_A = 150$ $\sum R_M = 135$ $\sum (R_A - \overline{R_A})*(R_M - \overline{R_M}) = 221$ $(R_M - \overline{R_M})^2 = 624$

$\overline{R_A} = 10$ $\overline{R_M} = 9$

So Beta = 221/624 =.3541

Zero beta: This is another rarity, where the price of stock stays same over time irrespective of market movement. This can sometimes happen in sideways moving markets, where no major economic /industry/ company news is coming up.

Beta less than one: This happens when the stock price moves less in comparison of market. Many blue-chip and large-cap company stocks have beta value less than one, which make them qualify for low-risk investments. But these stocks tend to offer low-returns; and are not so suitable for short-term trading.

Beta of one: This happens when the stock price movement is same as that of market. This is true for many index-linked stocks and funds.

Beta greater than one: Beta exceeds one when the stock price movement surpass market movement. Many fast growing, mid and small-cap company stocks have beta higher than one. These stocks tend to offer better return for high-risk taken, but many of them are less suitable for long-term investing. Remember, very high beta levels may indicate low liquidity causing increase in volatility.

Negative beta: This is an interesting but rare condition where the price of the stock moves in reverse direction to the market movement. Usually no stock has prolonged negative beta value as most (all) them move with the market.

Staple stocks are thought to be less affected by cycles. Such stocks are not severally affected by major economic trends say inflation or recession and usually have lower beta.Globally, companies in the consumer goods sector, especially FMCG, pharma and Healthcare products, are considered to be non-cyclical and are thus, low-beta in nature. For ex. Nestle, HUL, Godrej Consumer Products, ITC, Aventis, GSK Pharma etc.

3.7 SECURITY MARKET LINE

The Security Market Line represents the average or normal, trade-off between risk and return for a group of securities – where risk is measured typically, in terms of Beta value of the securities.

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

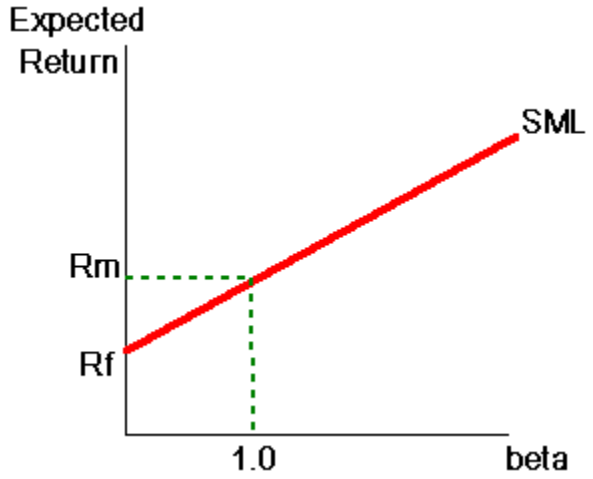


Fig 3.6 (a) Security Market Line

The red line is the Security Market Line in the above diagram. Assets which are fairly priced plot exactly on SML. Underpriced securities plot above SML, whereas overpriced plot below the SML. The difference between the actual expected return and fair return as per SMLis called the security's alpha.

How to develop a security market line:

Let's assume that the risk free rate is 5%, and the overall stock market will produce a rate of return of 12.5% next year. Now put few sample betas into equation and you get the SML

I f you make a graph of this situation, it would look like this:

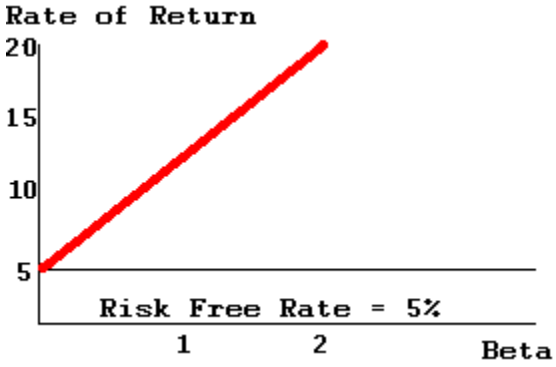


Fig 3.6 (b) Security Market Line

On the horizontal axis are the betas of all companies in the market

On the vertical axis are the required rates of return, as a percentage

The red line is the Security Market Line.

Consider GSK Ltd which has a beta say 1.33333 So the fair return as per SML is

5%+1.33(12.5-5)= 15%. But if investors do expect 20% return from this stock then

Alpha = 20-15=5%

3.8 SUMMARY

Return is nothing but the reward for undertaking investment. Assessment of historical returns is must to know the performance of the fund manager. This also helps as an important input to estimate future returns.Risk is defined as the possibility of the actual return being different from the expected return on an investment over the period of investment. Low risk leads to low returns. For instance, in case of government securities, while the rate of return is low, the risk of defaulting is also low. High risks lead to higher potential returns, but may also lead to higher losses. Long-term returns on stocks are much higher than the returns on Government securities, but the risk of losing money is also higher.

The risk and return trade off says that the potential return rises with an increase in risk. It is important for an investor to decide on a balance between the desire for the lowest possible risk and highest possible return.

This unit examined ways to quantify historical return and risk to help analyze alternative investment opportunities. We considered two measures of mean return (arithmetic and geometric) and applied these to a historical series for an individual investment and to a portfolio of investments during a period of time. We considered the concept of uncertainty and alternative measures of risk (the variance, standard deviation, and a relative measure of risk—the coefficient of variation).

3.9 GLOSSARY

Risk Free Rate: It is a compensation for time and risk premium for risk.

Risk – Return Trade Off: Levelling of risk and return is known as risk – return trade off.

Beta: The β is a sensitivity measurement, indicating the relationship between prices of a share and market in general. It is the way to represent the association of the share price with the index of the market. It is used to indicate the level of systematic risk of a share.

3.10 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress –A

5. Answer

a) startup, growth, maturity, decline

b) Chief Financial Officer or Finance Director

c) Operational, Managerial and Strategic

d) High/High Or Low/Low

e) Internal Rate of Return, Net Present Value

f) sovereign risk

6. Answer

a) False, Financial management and accounting are distinct from each other

b) True

c) True

d) False, NPV of both projects will be different due to the discounting of the returns over varying periods of time.

e) False, Liquidity management and cash flows are an important element in financial management

3.11 REFERENCES

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3.13 TERMINAL QUESTIONS

Q1. What is the meaning of risk?

Q2. How is the rate of return on an asset defined?

Q3. Explain risk-return trade off.

Q4. What is Beta? How is it interpreted?