
UNIT 2 COMPONENTS OF INVESTMENT RISK

Objectives

The objectives of this unit are to:

- Explain the concept of risk and genesis of total investment risk
- Distinguish between 'systematic' and 'unsystematic' risk
- Identify the factors that specially affect risk in investment in equity shares.

Structure

- 2.1 Concept of Investment Risk
- 2.2 Evolution of Risk Connotations
- 2.3 Interest Rate Risk
- 2.4 Market Risk
- 2.5 Inflation Risk
- 2.6 Default Risk
- 2.7 Business Risk
- 2.8 Financial Risk
- 2.9 Management Risk
- 2.10 Liquidity Risk
- 2.11 Summary
- 2.12 Key Words
- 2.13 Self-Assessment Questions/Exercises
- 2.14 Further Readings

2.1 CONCEPT OF INVESTMENT RISK

In Unit-1, while reading return-risk trade off function, you have come across terms like 'risky assets', 'risk-averse investors', 'risk-free rate' and so on but no formal input on the term 'risk' was given. In this Unit, the concept of risk is discussed in detail because no investment decision can be taken without understanding the risk associated with the investment. The importance of risk in investment decision can be appreciated if you ask the investors why they invest one part of their savings in bonds and the other part in equity. If risk is not a relevant factor in investment decision, investor should bet all their savings only in equity stocks, which offer on average higher return than debt instruments. Investors not only like return but they also dislike risk. Many investors may be willing to take some amount of risk since it is the only way to earn higher return but they need compensation for taking such additional risk. Thus, investment decision not only requires an estimation of return but also an assessment of risk to find whether the return from a risky asset is adequate for the risk assumed by the investors.

The word 'risk' is common vocabulary and is widely used in the world of investments. In normal life, the term risk often means a negative outcome. If you say that it is risky to drive vehicle in a particular road, you actually mean that driving in that road may cause an accident. However, the term risk in investments has a different meaning. It not only refers to a scope of negative occurrence but also implies the chance of positive return. For example, we mentioned in Unit 1 that investment in stocks is riskier than investments in bond.



It doesn't mean that investments in stocks will yield a negative return or it will be lower than bond return. It simply means that investments in stocks may offer a high return or also a huge loss. Risk captures variation in expected return and such uncertainty of return is invest in risky investments, the expected return needs to be higher. When such higher expected return is used for discounting the future cash flows, the security value moves downward. This way you can see a link between risk and return. We will discuss more on this relationship as we move further on this topic.

Since investment decisions are made based on the expected future outcome, we can broadly classify our understanding and knowledge on future into *four categories*. At one extreme, we have certain knowledge. If an investor invests in government security, it is almost certain that the government pays interest and principal on the due date. Only in extreme conditions, the government may fail to honour the commitment. At the other extreme, we have no idea on the future and we can call this as our ignorance. Suppose a company comes out with a public issue stating that they will take up a research to develop a process that will *convert* iron into gold. Many of us may not be able to judge the outcome because we may not have any idea on the feasibility. No rational investment decision is feasible when we are ignorant of possible outcome.

The third one is a situation where we know the possible outcomes and its range. Suppose we are able to estimate that India Cement's earning will grow by 30% if the economy does well and will decline by 10% if the economy fails. If we don't know anything beyond that, then the situation is called as uncertain. It is again difficult to take a rational investment decision in a situation of uncertainty. If we are able to know the probability of the economy doing well or failing, then the situation is called risky. In other words, a situation pertaining to future is considered as risky If we know the range of outcome and its probability distribution. For example, in the above India Cement's case, if we know the probability of economy doing well next year is 70% and the probability of economy failing is 30%, then we can estimate the India Cement's earnings in a better way. Under this condition, the earnings of India Cements will increase by 30% with 70% probability and decline by 10% with 30% probability.

Two elements in the concept of risk as applied to the world of investment and finance deserve attention. **One**, risk in the investment sense is associated with return. A person buys a financial asset with expectations of a return. The investment decision would be premised on an 'expected return', which may or may not actually be realized. The chance of an 'unexpected' or 'adverse' return would be the risk carried by an investment decision. For example, you buy a share at Rs.370 expecting a dividend of Rs. 6 per share in the coming year and expecting the price to rise to Rs.450 in a year's time. You are basing your decision to buy on a return of

$$\frac{(450 - 370) + 6.0}{370} = 23.2 \text{ percent.}$$

Now, the price may rise only to Rs. 380 in which case the actual return downs to a mere 4.2 percent, if the company comes out with a dividend of Rs. 6 per share on a Rs. 10 equity share. Should the dividend be pruned to Rs. 4 per share, the return would further fall to 3.3 per cent. The **other** point to be stressed about investment risk is that it is generally considered synonymous with uncertainty. The investor is most of the time dealing with uncertainty and yet figuring out his subjective probabilities for the expected return. The risk-zone in which the investor moves is characterized by 'stochastic knowledge' and his beliefs about the expected return enable him to work out a probability distribution of possible outcomes. This is illustrated in the paragraph that follows.

Assume that you are interested in buying 1000 equity shares of a company. The market price as on October 1, 2001 of a ten-rupee share is Rs.200. The highest prices were 1998-99: Rs. 135; 1999-2000: Rs. 146; and 2000-01: Rs.235. You expect the price to go up to Rs. 250 within a year of your purchase. The company paid the following dividends 1998-99: 23%; 1999-2000: 30% and 2000-01: 32%. There has been a liberal record of five bonuses in the past, the last bonus being in 1997-98 in the ratio of 1:1. This information enables you to figure an expected return of 26.6% assuming that the company will maintain the dividend of



32% in 2001-02 and that the price at the time of your sale will be Rs 250. The expected return of 26.6% was derived as follows. The investor gets a dividend of Rs. 3.20 and a capital gain of Rs. 50 when she sells the stock at Rs. 250. The net gain of Rs. 53.20 for an investment of Rs. 200 works out to 26.6%.

The figure you have estimated above is a single estimate of expected return. Since future is uncertain, you may have to examine the probability of several other possible returns. Thus, the expected return may be 20%, 30%, 35% or 10%. Now, you will have to assign the chances of occurrence of these alternative possible returns on the basis of your information and subjective beliefs. For example, you expect as follows:

| Possible return (X_i) | Probability Occurrence ($P(X_i)$) |
|---------------------------|-------------------------------------|
| 10% | 0.10 |
| 20% | 0.20 |
| 26.6% | 0.40 |
| 30% | 0.20 |
| 35% | 0.10 |

You are clearly now not working on a point estimate. The earlier estimate of 26.6% is one of the five sets of outcomes you have generated. The table above is known as a probability distribution and you can use it to have an insight into the riskiness of your proposal to buy 1000 shares. The procedure would be as follows:

- i) Estimate the expected value of the five possible outcomes. If the possible returns are denoted by X_i and the related probabilities by $P(X_i)$, the expected value (EV) is

$$EV = \sum_{i=1}^n X_i P(X_i)$$

In other words, it is the sum of products of possible returns with their respective probabilities.

- ii) You will be in a position to have some idea of risk by estimating the variability of possible outcomes from the expected value of outcomes that you have estimated in (i) above. A statistical procedure used for the purpose is the calculation of standard deviation which is given as follows:

$$\sigma = \sqrt{\sum_{i=1}^n [(X_i - EV)^2 P(X_i)]}$$

Where ' σ ' denotes standard deviation and all other terms as in (i) above. The table below provides the required calculations:

| Possible Return (X_i) | Probability ($P(X_i)$) | Products | Deviations | Deviation Squared | Deviation Squared x P(X_i) |
|---------------------------|--------------------------|-----------------|--------------------|------------------------|--------------------------------|
| (1) | (2) | (3) = (1) x (2) | (4) ($X_i - EV$) | (5) = (4) ² | (6) |
| 10.0% | 0.1 | 0.0100 | -0.15 | 0.0229 | 0.0023 |
| 20.0% | 0.2 | 0.0400 | -0.05 | 0.0026 | 0.0005 |
| 26.6% | 0.4 | 0.1064 | 0.01 | 0.0002 | 0.0001 |
| 30.0% | 0.2 | 0.0600 | 0.05 | 0.0024 | 0.0005 |
| 35.0% | 0.1 | 0.0350 | 0.10 | 0.0097 | 0.0010 |
| EV | | 0.2514 | | σ^2 | 0.0044 |

$$\sigma = \sqrt{0.0044} = 0.0660$$



- iii) The above calculations can be repeated for several stocks and if the investor's objective is to minimize risk, the one with minimum standard deviation can be selected. Suppose there is another stock which offers same expected return of 25.14% but the standard deviation of return is lower than 0.0660. Then investors will prefer the new stock, which offer lower risk with same return. You may note that squared standard deviation (σ^2) is known as 'variance' and is an equally useful measure of risk.

Activity - 1

1. a) How many possible return outcomes could be estimated for a Government security?
.....
 - b) What would be the probability of occurrence of the 'outcome(s)' in (a) above?
.....
 - c) State how would you figure the one-period return on a risky security?
.....
 - d) What does the standard deviation of possible return show?
.....
 - e) Define risk.
.....
 - f) Can risk of an investment be considered without reference to return?
.....
2. Go through the illustration used above to explain the methodology of computing expected return and risk. Perform a similar analysis for another stock, which you are familiar with using the same methodology. Try to give justification of the probability values that you are assigning though it will be difficult task but worth to make an attempt.
.....
.....
.....
.....

2.2 EVOLUTION OF RISK CONNOTATIONS

Section 2.1 had introduced you to a procedure of measuring investment risk, which has emerged as a standard approach. It may be of interest for you to know that this concept and its, later refinements have evolved over a time-period. In the early years of the present century, analysts used financial statement data for evaluating the risk of securities of a company. The broad indicators used by them were the amount of debt employed by the firm. Their rule was: 'the higher the amount of debt the greater the riskiness of security and Graham, Dodd and Cottle, who are considered pioneers of 'security analysis' as a discipline laid emphasis on 'margin of safety' as a measure of risk in the 1962 edition of their monumental work titled 'Security Analysis'. They were of the view that security analysis must calculate the 'intrinsic value' of a security independent of its market price. According to them, 'intrinsic value of a security would be a security analyst's own judgement based on its earning power and financial characteristics and without reference to its market price. The difference between 'intrinsic value' and 'market price' was called the 'margin of safety' and the rule used for assessment of risk was 'the higher the margin of safety, the lower the risk.'



Graham and Dodd not only concentrated on the individual security but also recognized the importance of its contribution to the risk of a well-diversified portfolio. It must, however, be mentioned that what brought the concepts of risk for a portfolio and a security under a clearer focus was the work of Markowitz and the later development of the capital asset pricing model (CAPM). You will know more about these developments in the area of investment risk in Block IV. In case you liked to know about the original underpinnings of the work done by Markowitz, you may refer to his classical article published in the March 1952 issue of the *Journal of Finance* with the caption, "*Portfolio Selection*".

Several measures, other than the standard deviation discussed in the preceding section, have been used to measure risk viz., range, semi-variance, and mean absolute deviation. But standard deviation has been accepted in general because its knowledge permits probability statements for most types of distributions. William Sharpe observes as follows in support of the measure: "The standard deviation of a portfolio's return can be determined from (among other things) the standard deviations of the returns of its component securities, no matter what the distribution is. No other relationship of comparable simplicity exists for most other variability measures." (See: W. Sharpe, *Investments*, 2nd ed. 1981, p.121). You may note that the risk of a portfolio is not just the mathematical addition of the risk of each of the individual securities that comprise. You may further note that where the portfolio is well diversified, portfolio risk would be less than this mathematical total.

You would have also come across a statement in this unit that the standard deviation measures the total risk of an investment. The later developments, in the theory of investment risk decompose this 'total' into several of its components. And this can be done in two ways. One, dividing total risk into systematic and unsystematic risk and two, dividing total risk into parts such that each of which has an origin in some causal force. Obviously, the first part of the decomposition exercise is broad and has relation to the market. The second part of the exercise relates to the factors or causes which produce risk in investments.

The division of total risk into 'systematic' and 'unsystematic' or 'non-systematic' owes its origin to developments in the area of portfolio theory. Sources of risk that cause variability of returns may be perceived as belonging to two general classes—those that are pervasive and affect all securities though in varying degrees e.g., inflation, interest rates, market sentiment, etc., and those that are specific to a particular security e.g., financial risk and business risk. When variability of returns moves with the market, it is recognized as 'systematic'. Firms cannot eliminate such a risk and they are of major concern to the investor. For example, when prices rise, all firms would be affected in terms of their costs and realizations, which in turn would affect variability of returns. This will be a market phenomenon and would tend to stay for all. The investor would demand compensation for this risk component in figuring out his expected rate of return. On the other hand, when variability of returns occurs because of firm-specific factors like the failure to obtain a prestigious overseas contract, or a higher exposure to the risk of default in payment of interest charges and debt obligations, the risk is termed 'non-systematic'. Since this part of risk can be reduced through a diversified portfolio, it is not considered while computing the expected or required rate of return.

The two components of total risk are additive and hence total risk is equal to Systematic risk *plus* Non-systematic risk. Systematic risk is normally measured by comparing the stock's performance vis-a-vis market's performance under different conditions. For example, in a good period, if the stock appreciates more than other stocks in the market and in a bad period, it depreciates more than other stocks in the market, the systematic risk of the stock is more than the market risk. The systematic risk of the market (normally widespread market index like BSE-100 or NSE-50 index) is equal to 1 and systematic risk of all stocks is expressed in terms of systematic risk of market index. This is done by measuring a value called 'beta'. The beta of the stock is equal to beta of the regression coefficient when stock's of returns are regressed on return of market - index. If the beta of stock is 1.50, then the stock is expected to show a price increase of 1.5 times of stock returns in a good period. At the same time, if the market declines by some percentage in a bad period, the stock is expected to decline 1.5 times more than market's negative return.



For illustrative purpose, the weekly price and return data BSE-100 index, Hindustan Lever, Infosys and Reliance Industries are given in Appendix-1 of this Unit for a period of six months (July, 2000 to June, 2001). Using the return data and regression, the beta values of the three individual stocks are computed. As expected Hindustan Lever's beta shows the lowest value and is 0.49. The stock is less volatile during the period. The market as a whole (measured through BSE-100 index) has reported a net loss of 32% during the six months period, whereas HLL has suffered a net loss of 27.60% during the same period. A week-to-week comparison shows that HLL suffered less or posted profit when the market was reporting loss during the week. On the other hand, Reliance Industries reported a gain of 8.30% against the market loss of 32%. Again a week to week comparison shows the Reliance Industries weekly return are closely moving in line with BSE-100 and hence got a beta value of 0.96, which is close to market's beta of 1. Infosys showed wide variation during the period. Against a market loss of 32%, Infosys reported a net loss of 54.79% and also showed *high* volatility in the returns. The beta of 1.82 reflected the volatility. Thus, the systematic risk of HLL is the lowest and Infosys is highest whereas Reliance Industries has shown a moderate systematic risk. The unsystematic risk of the stock is equal to total risk less systematic risk. It is computed as follows:

$$\text{Unsystematic Risk} = \text{Variance of the stock} - [\text{Beta}^2 \times \text{Variance of the Market Index}]$$

Sometime, the unsystematic risk is expressed as a standard deviation. For the three illustrative stocks, the systematic and unsystematic measures are as follows:

| | BSE-100 | HLL | Infosys | Reliance |
|------------------------------|---------|---------|---------|----------|
| Total Risk (variance) | 0.0024 | 0.0029 | 0.0111 | 0.0037 |
| Beta | 1.0000 | -0.0444 | -0.8528 | -0.1588 |
| Systematic Risk (variance) | 0.00024 | 0.0011 | 0.0043 | 0.0023 |
| Unsystematic Risk (variance) | 0 | 0.0017 | 0.0069 | 0.0014 |
| Unsystematic Risk (SD) | 0 | 4.13% | 8.28% | 3.73% |

Activity-2

Indicate whether the following statements are True or False:

- Margin of safety is the difference between intrinsic value and market price
.....
- Standard deviation is a better measure of risk because it can explain all distributions.....
- Total investment risk cannot be calculated by absolute mean deviations
- Systematic risk can be eliminated
- A government security, a bond, and an equity share cannot form a Portfolio.....
- Inflation creates diversifiable risk
- A diversified portfolio consists of securities, which yield maximum returns.....

2.3 INTEREST RATE RISK

In the previous section, we discussed that there are several reasons for the future return varying from the expected return and we grouped them under two broad categories. Our discussion was more on measuring different components of risk and now we will discuss more on understanding different sources of risk. To start with, we will discuss an important source of risk namely interest rate risk, which affects every sector in the economy. Often



government through RBI uses interest rates to push the economy forward or cool down the heated economy. Interest rate risk arises from variations in such rates, which cause changes in market prices. It can be seen that a rise in market interest rates causes a decline in market prices of securities and vice versa. There are different ways through which the interest rate affects the securities return. It affects the expected or required rate of return because investors always compare risk-free return with the expected return of an investment. An increase in interest rate will cause an increase in expected or required rate of return of other investments.

Illustration

Assume a 14% secured non-convertible debenture of Rs. 200 for five years. As long as the market interest rate remains at 14%, the value of debenture will be equal to Rs. 200. Suppose the interest rate in the market increases to 20%, it affects the prices of debenture because an investor, who is willing to buy the debenture would expect a return of 20% and hence discount the cash flows at 20%.

Solution

| Year-end | Cash Flow (Rs.) | Present Value at 20% |
|----------|-----------------|----------------------|
| 1 | 28 | 23.33 |
| 2 | 28 | 19.44 |
| 3 | 28 | 16.20 |
| 4 | 28 | 13.50 |
| 5 | 228 | 91.63 |
| Total | | 164.11 |

The debenture price will decline from Rs. 200 to 164.11.

Interest rate risk affects largely the securities with longer duration. For instance, if there is another non-convertible debenture with 10 year maturity, its price would decline to Rs. 149.69 from Rs. 200 if the interest rate increases from 14% to 20%. The workings are as follows:

| Year-end | Cash Flow (Rs.) | Present Value at 20% |
|----------|-----------------|----------------------|
| 1 | 28 | 23.33 |
| 2 | 28 | 19.44 |
| 3 | 28 | 16.20 |
| 4 | 28 | 13.50 |
| 5 | 28 | 11.25 |
| 6 | 28 | 9.38 |
| 7 | 28 | 7.81 |
| 8 | 28 | 6.51 |
| 9 | 28 | 5.43 |
| 10 | 228 | 36.82 |
| Total | | 149.69 |

Now let us know, how the interest rate risk affects stock price? Since stocks have no maturity, the interest rate changes affect the stock prices more than bonds. Secondly, increase in interest rates also reduces the profit of the companies and hence securities



prices are negatively affected. It can now be stated that the market prices (or present values) of securities would be inversely related both to market interest rates (or yield to maturity) and duration. You will recognize that the interest rate risk is the price fluctuation risk, which the investor is likely to face when interest rates change.

With a view to avoid the interest rate and duration risk, the investor, may like to invest in short-term securities. Rather than buying a 5-year debenture, he may buy a one-year security every time the earlier one-year security matures. This strategy, though successful in reducing the interest rate or the price fluctuation, would possibly expose the investor to another risk. Even the coupon rates in successive short-term securities may vary and the range of variation may be wide too. For instance, during the last few years, interest rates are constantly coming down and bank and financial institutions like IDBI and IFCI have reduced their interest rates. What the investor would now encounter is the 'coupon rate risk'. It will be the constant endeavour of investor to weigh between the interest rate risk and the coupon rate risk while keeping funds invested over his holding period.

You would have noticed in our discussion of financial instruments in Unit 1 that interest payments on bonds and debentures are contractual payments and the company can be sued for default. Cumulative preference dividends must also be paid to avoid trouble from preference shareholders. Equity dividends can always be skipped if the company is in deep financial trouble and a dividend payment would hasten insolvency. In such a situation the cash dividend yield will be much more risky than the coupon yield on debentures.

2.4 MARKET RISK

You would have observed that the market moves upward at some point of time and then moves downward at some other point of time. Such movements may happen despite the good or bad performance of the companies. Often, company management and its employees will be puzzled why the market is behaving like this. Finance Ministers and economic advisors have gone on record stating that they don't understand the behavior of the market when it takes a beating after the presentation of budget. Irrespective of our understanding, the reality is the market move in one of the two directions (upward or downward) and once such trend starts, it exists for a time. There are several reasons behind such movements. Changes in economy or expectation about the future of the economy may cause such widespread movement. Company specific news may also cause such movement and if the company is a major one like Reliance or Infosys or Hindustan Lever, a positive or negative development may generally affect several other stocks in the market. Similarly, a shock in the U.S. market will have an impact on domestic stock prices.

Investors' psychology will also often contribute to the market risk. For instance, negative news may create a panic in the market and everyone would like to sell the stock without any buyer in the market. In this process, the market will decline more than the desired level. Market risk is demonstrated by the increased variability of investor returns due to alternating bouts to bull and bear phases. Efforts to minimize this component of total investment risk require a fair anticipation of a particular phase. This needs an understanding of the basic cause for the two market phases.

It has been found that business cycles are a major determinant of the timing and extent of the bull and bear market phases. This would suggest that the ups and downs in securities markets would follow the cycle of expansion and recession in the economy. A bear market triggers pessimism and price falls on an extensive scale. There is empirical evidence, which suggests that it is difficult for investors to avoid losing in bear markets. Of course, there could be exceptions.

The question of protection against market risk naturally arises. Investors can protect their portfolios by withdrawing invested funds before the onset of the bear market. A simple rule to follow would be: 'buy just before the security prices rise in a bull market and sell just before the onset of the bear market', that is, buy low and sell high. This is called **good investment timing** but often difficult to practice.

Market risk as pointed out earlier is also classified as systematic and non-systematic. When combinations of systematic forces cause the majority of shares to rise during a bull market and fall during a bear market, a situation called systematic market risk is created. As



already noted, a minority of securities would be negatively correlated to the prevailing market trend. These unsystematic securities face diversifiable market risk. For example, firms granted a valuable patent of obtaining a profitable additional market share might find its share prices rising even when overall gloom prevails in the market. Such unsystematic price fluctuations are diversifiable and the securities facing them can be combined with some other shares so that the resulting diversified portfolio offsets the non-systematic losses by gains from other -systematic securities.

2.5 INFLATION RISK

Inflation risk is the variability in the total purchasing power of an asset. It arises from the rising general price level. The interest rate on bonds and debentures and dividend rates on equity and preference shares are stated in money terms and if the general price level rises during some future period, the buying power of the cash interest/dividend income is likely to be received for that period would decline. And if the rate of inflation is equal to the money rate of return, the investor does not add anything to his existing wealth since he obtains a zero rate of return.

Many investors believe that if the market prices of their financial assets increase, they are financially better off in spite of inflation. Their argument is 'after all money is increasing'. This is nothing but 'money illusion'. Consider, for instance, a situation when the market price of a security you are holding, doubles and the general price level increases four-fold. Would you say that you are richer simply because your **command over money** doubles by selling the security? True, you get more money than what you had earlier but you can buy less with that money. You can't dismiss the fact that your **command over goods and services** (which is the eventual objective of all investment decisions) has declined due to a four-fold rise in prices in general.

The money illusion is partly rectified by obtaining real rates of return (interest/dividend cash income + capital gains) that is equivalent to the inflation-adjusted monetary or nominal rates of return. If the real rate of return is denoted by R_r , inflation rate by q , coupon rate by 'r' and nominal rate of return by R , then:

$$R_r = \frac{1.0 + r}{1.0 + q} - 1$$

For example, a Rs.500 debenture earns a coupon rate of 15% per annum. Inflation rate expected in the coming one-year period is 12%. Then the real rate of return would be :

$$R_r = \frac{1.15}{1.12} - 1 = 1.027 - 1 = .027 \text{ or } 2.7\%$$

You may notice the drastic fall in the real rate of return to 2.27% from the coupon rate of 15% due to inflation rate of 12%.

Again, an equity share of Rs. 10 promises a dividend of 20% and you expect the price of the share to rise from the current level of Rs.60 to Rs. 80 in a year's time. Inflation during the next year is estimated at 14%. The real rate of return would be :

$$\begin{aligned} \text{Nominal rate } \{R\} &= \frac{(\text{Rs. } 80 - \text{Rs. } 60) + 2.0}{\text{Rs. } 60} = 36.7\% \\ \text{Real rate of Return } (R_r) &= \frac{1 + .367}{1 + 1.4} - 1 = \frac{1.367}{1.14} - 1 \\ &= 1.199 - 1 = .199 \text{ or } 19.9\% \end{aligned}$$

The above examples clearly highlight the effects of purchasing power risk on the wealth and returns of an investor.



A question is sometimes asked about negative real rates of returns, that is, a situation where the inflation rate exceeds the nominal rate. Should an investor stop investing in such situations? The answer would depend on what other alternatives the investor would have in the event of not investing. If the money withheld from investment is kept as idle cash with zero nominal return then investing even with negative real returns, may be advisable because, as shown in the example below, non-investment would yield a larger negative real return than investing. And even though normal investment objectives would be to earn positive real rates, in abnormal situations like the one stated above, the objective would be to reduce the negative real rate of return.

Assume that a security is expected to yield a nominal rate of return of 12% and the rate of inflation is expected to be 15%. We have now to work out the choices of the investor, further assuming that if he does not invest, his cash will have to remain idle.

Now, if our hypothetical investor decides to invest his real rate of return would be :

$$R_r = \frac{1 + r}{1 + q} - 1 = \frac{1.12}{1.15} - 1 = .974 - 1.0 = - 0.026$$

It works out to a negative 2.6% return. Should the investor decide to keep idle cash, the real rate of return would be :

$$\begin{aligned} R_r &= \frac{1 + 0.0}{1 + 15\%} - 1 = \frac{1.0}{1.15} - 1 \\ &= .869 - 1.0 = - 0.131 \end{aligned}$$

It would be better to have a negative return of 2.6 than to end with a negative return of 13.1% by keeping cash idle.

You have seen that the purchasing power risk arises even if the market prices of assets rise. Likewise, this risk may emerge even if the asset prices do not fluctuate. The reason for these relationships is that the purchasing power risk arises from fluctuations in the purchasing power of real income and/or real price of assets and not from fluctuations in buying power of their nominal income and/or nominal prices.

It has already been stated that investment assets are real assets like land, real estate, gold, diamonds and financial or monetary assets like shares, bonds, and debentures. It has been observed that prices of real assets move with inflation and are positively correlated with it. In contrast, prices of monetary assets are relatively rigid and are negatively correlated with inflation. In consequence, real assets do not lose purchasing power, as do the monetary assets in periods of inflation. In other words, real assets are good inflation hedges but monetary assets are not. Hence, monetary assets cannot form part of a portfolio, which already has got a high degree of purchasing power risk. Such a portfolio can be diversified with real assets.

Activity-3

- I. Collect monthly data of movements in the BSE-100 Index for the last few years. Refer Appendix-2 for the values form 1990 to 2001. Plot them on a graph with months and years on the horizontal scale and Index levels on the vertical scale. Read the resulting graph and point out.
 - a) No. of peaks
 - b) No. of troughs
 - c) Duration of all peaks and troughs
 - d) Average duration of all peaks and troughs.

Also prepare a brief comment on the information of 'bull' and 'bear' markets from the information that you obtained.

.....
.....
.....
.....

II. Tick the correct alternative in the following multiple-choice questions:

- a) Market risk
 - (i) is an unimportant source of investor's total variability of returns
 - (ii) can be diversified away
 - (iii) arises primarily from the economy level cycle of recession and expansion
- b) The real rate of return is
 - (i) the inflation-adjusted rate of return
 - (ii) the rate at which an investor's purchasing power declines
 - (iii) both (i) & (ii) above
- c) Interest rate risk is
 - (i) the variability of return that arises from fluctuations in market interest rates
 - (ii) perfectly identical with unpredictability of future dividend rates
 - (iii) the difference between coupon rates on Government securities and those on corporate debentures.
- d) The interest rate risk on a government security
 - (i) is zero
 - (ii) is influenced by variations in market interest rates
 - (iii) is indicated by changes announced in coupon rates.

2.6 DEFAULT RISK

The default risk arises from a deterioration of financial strength of the company that issues securities. Holders of such securities have to experience greater variability of returns when financial strength begins to worsen. Since the basic parameter is 'financial health', default risk is also known as financial risk.

If not handled properly, the default episodes of a firm may as well finally end up in bankruptcy. This would, however, not be quite a swift process and one may notice warning signals before the final disaster strikes. For example, a company may begin stopping payment of its bills, accumulate arrears of cumulative preference dividends and accrued interest on loans, default on debenture interest, incur persistent losses, slash the equity dividend, and finally skip it, and so on. In more objective terms, adverse movements in financial ratios like the current ratio, the acid-test ratio, the cash to operating expense ratio, the net-worth to total assets ratio and so on can be put on the watch. The point is that bankruptcy will not be a bolt from the blue except when an act of nature destroys all assets, which are not insured.



Firms operating in the financial services sector like CRISIL, CARE and ICRA undertake an ongoing exercise to provide quality-ratings to the debt instruments of issuing companies. They are at present being solicited in India by companies who want to raise funds from the capital market. In Western countries, the rating programme is a voluntary and continual exercise performed by eminent firms like Standard & Poor and Merin Lynch etc. Ratings as given by these agencies are a significant aid to the investor in estimating the probabilities of default in a particular debt issue.

When the first sign of a weakening financial health of a firm is noticed, market price of its security react and take a deep dip. The price decline will be equal to the estimated loss when the company goes into bankruptcy. The immediate target groups would be lenders and loan creditors but ultimately even shareholders would suffer. In fact, if the worst happens, losses of equity holders could be total and they may end up with share prices nearly dropping to zero. Also, even at such abysmally low levels, there may not be any takers.

As with other risk factors, there may be diversifiable and non-diversifiable components of default risk. Thus, tight credit conditions created by Reserve Bank of India would push up interest rates and financially weak companies may not be able to borrow. Similarly, a recession may curtail order position of the firms and firms that are already weak may start defaulting when their sales and income decline. These are examples of systematic forces that affect all firms simultaneously and systematically push them towards default. You should note that these are extraordinary circumstances and would push up the normal default rate of firms. The systematic element in default risk is more harmful to the investor than the diversifiable one. The latter can be anticipated and managed. For example, a government security can be added to the portfolio unless securities exposed to normal default risk themselves are yielding an average return that is very much in excess of the default-free securities.

2.7 BUSINESS RISK

Firms operate in an environment, which often changes and such changes causes variation in expected income. For example, a change in government policy on fertilizer subsidy may affect a group of companies in the fertilizer industry. Similarly, an action by a competitor, domestic or from outside may also affect other companies. While the above changes in the environment are caused by certain entities, there are several factors, which change the operating environment but can't be attributed to anyone. For instance, many firms are exposed to business cycle and the income of such firms significantly differs from period to period. Companies in steel, auto and shipping industries are exposed to such business cycles. It is difficult to assess whether the business risk is systematic or non-systematic. A diversified portfolio consisting of securities of several industries can diversify such business risk to a great extent. On the other hand, portfolios with few stocks or stock drawn from select industries would be exposed to such business risk if all sectors of the portfolio were affected by changes in the environment.

1.8 FINANCIAL RISK

Financial risk arises when the firm uses debt in its capital structure. Debt brings fixed liability and hence increases the variability of income available to the equity shareholders. Use of debt is not always bad. It will increase the profitability when the company performs well and equity holders get a return more than what is available otherwise. Debt creates problem in bad times because of the fixed liability. If the company fails to meet the debt obligation, the managers need to spend a lot of time in convincing the lenders to accept delayed payment and in meanwhile lose valuable managerial time. Default easily spread bad words about the company and the company faces problem from several fronts. It may not be able to get credit from suppliers and some of the good workers may leave the company. Customers will also prefer companies with sound financials to avoid uncertainty in supply.

The impact of financial risk upto a limit is restricted only to the equity holders. But too much of debt creates problems even to existing debt security holders unless the debt is fully secured. Even in such cases, it is difficult to take charge of the assets and sell it to meet their liability in view of lengthy legal process.



2.9 MANAGEMENT RISK

Management risk is that part of total variability of return which is caused by managerial decisions in firms where owners are not managers. However qualified and capable the management team, there are chances for judgmental errors and wrong decisions. Owners-investors are rightly aggrieved when executives are paid high salaries and perks and are allowed ego-bolstering non-income consumption like luxury cars, lavishly furnished offices and yet they plunge the firm in severe difficulties by their inept decisions.

Management errors are the main reasons, which give rise to management risk component of total investor risk. The errors are so numerous that it is difficult to either list them or even to classify them. Nevertheless, some potential areas of management errors can be highlighted. The one great blunder that management might commit is to ignore product obsolescence. In fact, adequate expenditure must be made on R & D and alternative products are promoted before the life cycle of existing ones comes to an end. Single product firms will be more exposed to this risk than firms with diversified product lines. Another risk is the dependence of a firm on a single large customer. Management must adequately diversify customer groups. Many firms supplying military equipment have been found caught up in deep financial distress when the Government announces cuts in military spending. Many software companies are also facing this problem and making effort to diversify customers as well as country exposure. Yet one more area of management errors could be the wrong handling of a correct decision when it is subjected to unfair criticism and is even fought out in a court. For example, an automobile manufacturer develops a fuel-efficient small car much ahead of times. Some ardent consumer protection group brings a lawsuit on the grounds of user-safety being threatened. The firm then announces abandonment of the product, forcing investors to bear the loss of investments and lost revenues in future. You should note that these cases are only illustrative and the list may go to an infinite number of factors.

Agency Theory and Management Risk

A recent development in the area of explaining management risks is concerned with research that seeks to explain the basic motivations of owners and managers. It has been stated that owners work harder than managers, who do not have ownership interest in a company. Moreover, non-owner managers have strong incentives to consume non-pecuniary benefits since they are hired employees. The emerging theory hypothesizes that owner-non-managers delegate all authority to non-owner-managers, who then operate under a principal-agent relationship. Since ex-post rewards and punishments are not perfect and just, hired executives may not make, as much *ex ante* effort to generate profitable investment opportunities than they would if they owned the firm. Thus, there is a conflict of interest between owners and managers and the latter may abuse the authority delegated to them much to the detriment of owners. In consequence, investors, who are rational individuals, would pay a higher price for shares of owner-managed firms than for shares of employee-managed firms. The difference between the two sets of prices has been termed as 'agency cost'. It must be observed that the theory has not gone without criticism but the view is getting increasingly accepted.

Evaluating Management

Investors and security analysts must attempt to evaluate the management team of a company for its strengths and deficiencies. The task, though difficult and highly subjective, must be done using some vital checkpoints, which are briefly stated below:

- 1) Age, health, and experience profile of executives
- 2) Growth-orientation and aggressiveness of management
- 3) Composition of Board of Directors and the number of outside directors; Effectiveness of the Board.
- 4) Management depth of the firm i.e., extent of delegation and decentralization and development of managers at all levels with a strong middle-management team.



- 5) Dynamism and flexibility of management.
- 6) Dividend payout policy and cash dividend record
- 7) The depth and transparency of annual reports to shareholders (corporate disclosure practices)
- 8) Compensation to managers including special arrangements like stock option plans
- 9) Compliance record of environmental, consumer protection, and fair trade practices
- 10) Extent of implementing corporate governance codes

Diversifiable and Non-diversifiable Elements

Management errors are instances of management weaknesses. During normal periods, they go unnoticed but during periods of difficulty, not only are these errors conspicuously observed but also the responses of weak management become very poor.

Difficulties crop up when stresses are built up for all firms irrespective of the quality of management. For example, a shortage of petroleum products or emergence of a strong global competitor would aggravate problems and increase their number manifold. Since all firms would be affected, the investor would have no choice to diversify. Of course, he would sell off shares of firms with weaker management because they would be more prone to committing management errors during such stresses or systematic pressures. This would lower security prices of such firms and investors would hold them only if higher rates of return are offered. But while this may happen, there is no escape for the investor. If he moves from a weaker firm to a firm that is not so weak, systematic pressures would still work. Hence, this component of management risk is known as systematic or non-diversifiable risk.

It must be observed that even best managers can commit errors during normal periods. This would be a case of diversifiable management risk. Normal management errors occur randomly and investors can diversify by shifting their investments across companies.

2.10 LIQUIDITY RISK

Liquidity risk of securities results from the inability of a seller to dispose them off except by offering price discounts and commissions. It is easy to rank assets according to liquidity. The currency unit of a country is immediately saleable at par and no discount, etc., need be given. Government securities and blue chip shares are the next highly liquid group of assets. Debt securities and equity shares of some small and less known companies are less liquid or even illiquid. Lack of liquidity forces investors to sell the securities at a price below to the existing price, particularly when the quantity to be sold is large. Investors must consider the liquidity risk factor while selecting securities.

Activity-4

- I. Select a small and a medium-sized/large-sized company and visit their web site. Write a note on your experience after browsing the web site. Are you happy with the kind of information provided for investors in the web site? You can also visit a web site of foreign company and compare the contents provided in the web site of the company with Indian companies.

.....

.....

.....

.....

.....



- II. You are given four pair of statements below. Indicate, for each pair, which statement is true and which one is false.
- 1)
 - a) Default risk is always the risk of bankruptcy
 - b) Default may end up in bankruptcy
 - 2)
 - a) Liquidity risk results from a situation when securities cannot be sold except at a price discount.
 - b) Liquidity risk arises when the volume of trading is low
 - 3)
 - a) Being, absentee-owners, investors in general are more likely to commit management errors.
 - b) Managers who do not own equity shares are prone to commit management errors and magnify management risks.
 - 4)
 - a) The stronger among firms may be driven to a situation that it makes default
 - b) Bankruptcy does not spare even the financially strong firms.

2.11 SUMMARY

Considerations of risk are vital for investments. A potential investor looks at some expected return, which occurs in future. And what is certain about future is its uncertainty. A decision today for a tomorrow, which is uncertain, is the kind of topography on which an investor has to walk. The path is rugged and the journey full of risk. An intelligent investor would want to make his journey as smooth as possible. He would attempt to anticipate the kind of risks she is likely to face and also the vast number of factors that probably produce these risks. Even though she understands that her task is highly subjective, she makes her best efforts to remain anchored to cannons of rationality.

The two-step procedure that an investor follows in accomplishment of the objective is to get some specific insights into the total investment risk and then to familiarize with , various elements and factors that sum up to such total risk. For estimating the total risk, the investor uses past experience and modifies it appropriately for the expected changes, in the future and then develops a subjective probability distribution of possible returns from the proposed investment. This probability distribution is then employed to estimate the expected value of the return and its variability. The 'mean' gives the expected value and 'variance' or 'standard deviation' gives the variability or the measure of risk. The widely used procedure for assessing risk is known as the mean-variance approach.

The 'variance' or 'standard deviation' provides an overview of risk. It measures 'total risk'. In actual practice, various factors produce this total risk. A decomposition of total risk would be necessary to gain knowledge of the influence of these factors individually. Recognizing some recent developments in the theory of risk measurement, especially the portfolio aspects, a first step in reaching out to the components of total risk is to divide it into systematic or market-related risk and non-systematic or diversifiable risk.

When it comes to specifying the factors influencing total risk, one may group them into two broad classes, viz., factors, which produce non-diversifiable or systematic risk and factors which cause non-systematic or diversifiable risk. The former category comprises causes like interest rate variations, inflation, or market sentiment (or bull-bear market) which would affect all firms and their measurement will be useful in estimating required rate of return. The latter category would, on the other hand, include causes like business environment, financial leverage, management quality, liquidity, and chance of default. They affect some firms but no others. These sources of risk are expected to have minimum impact on a diversified portfolio and hence one need not be concerned with them too much.



2.12 KEY WORDS

Agency Theory: Documents the view that managers have incentives to consume as against owners who have motivation to work hard. The objective decision-making process is based on delegation of authority to executives who manage on behalf of owners. Agency theory postulates non-owner managers to be more susceptible to management errors.

Agency Cost: The difference between the value of a firm managed by executive delegates and the one managed by owners, the latter value being higher than the former.

Bear Market: A period (measured generally in months) during which the market indexes and prices of most shares decline in a given market. This phase is characterized by pessimism and low volume.

Bull Market: A period during which the market indexes and prices of most shares rise in value in a given market and when optimism prevails.

Coupon Rate Risk: The probability of the coupon rate of interest printed on the face of a debt security as a percentage of its face value being changed in successive short periods.

Diversifiable Risk: Variability of return caused by factors that are unique to one or a few securities. Such variability is averaged out to zero in a diversified portfolio and can, therefore, be eliminated.

Default Risk: The variability of returns to investors caused by changes in the probability that the company issuing securities might default. Also known as financial risk and/or bankruptcy risk.

Illiquid Assets: Assets including securities, which cannot be readily sold unless deep price discounts and/or commissions are given.

Inflation Hedge: An asset whose market price rises as fast or even faster than the rate of inflation so that the owner does not lose in terms of purchasing power.

Liquidity Risk: The probability that securities will not be sold out for cash without price discounts and/or commission.

Management Depth: An organisation structure, which provides for adequate decentralization, delegation, and opportunities for the development of managers at all levels.

Management Evaluation: An assessment of a firm's management and its aggressiveness, growth-orientation, research and development plans, utilization of board of directors depth, flexibility, ability to earn profits and stay abreast of modern developments, experience, education, and compensation plans.

Non-Diversifiable Risk: Variability in the investor's rates of return arising out of common and macro-level factors like an economic downturn, general rise in prices.. Increase in interest rates, and bull/bear phases of the securities market. All returns of securities are systematically affected by these factors. Hence, the risk is also known as 'systematic risk'.

Product Obsolescence: An old product suffering from reduced demand owing to superior technology of competitors and/or shifts in consumer taste.

Quality Ratings: Quality grades developed by rating firms and agencies, which indicate the relative probability that a security issue will default. These grades are indicated by different combinations of alphabets.

Recession: A period during which general business activity declines for several months or even a few years.

Trough: It occurs when general business activity has bottomed out at the end of a recession. The usual timing of a trough is at the end of a recession and the beginning of a recovery in business activity.



2.13 SELF-ASSESSMENT QUESTIONS/EXERCISES

- 1) Which of the following concepts of 'risk' would you consider better and why?
 - a) Margin of Safety
 - b) Debt Ratio
 - c) Standard deviation
- 2) Explain the following terms :
 - a) Diversifiable interest rate risk
 - b) Liquidity risk
 - c) Real rate of return
 - d) Peaks and troughs of business activity
 - e) Duration
- 3) Distinguish between
 - a) Financial risk and business risk
 - b) Diversifiable risk and Non-diversifiable risk
 - c) Nominal rate of return and Real rate of return
 - d) Market interest rate risk and coupon rate risk
 - e) Individual security risk and portfolio risk.
- 4) The following information is available for a hypothetical company:

| Year | Equity Share Price at end of year (Rs.) | Dividends for the year (Rs.) |
|------|--------------------------------------------|---------------------------------|
| 1998 | 24.70 | 1.105 |
| 1999 | 27.20 | 1.26 |
| 2000 | 36.30 | 1.42 |
| 2001 | 35.75 | 1.58 |
| 2002 | 38.25 | 1.62 |

If the share was bought at the beginning of each year at the closing price of the immediately preceding year and sold at the closing price of the year of purchase, calculate holding period yields for each of the years 1998, 1999, 2000 and 2001.

- 5) Match the words and phrases listed below with the most appropriate definitions or descriptions

Word or phrase

Definition or description

- | | |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 1) Undiversifiable management risk | a) The portion of an asset's total risk that is caused by discounts and selling commission that be given up to sell it. |
| 2) Agency cost | b) Variability of return caused by changes in the price level. |



- | | |
|--------------------------------|--------------------------------------------------------------------------------------------------------------|
| 3) Undiversifiable market risk | c) Difference in expenses at owner- and managed and employee-managed firms. |
| 4) Bull market | d) Costly management errors that occur systematically at the worst times. |
| 5) Purchasing power risk | e) Variability of return caused by simultaneous fluctuations in the price of most securities. |
| 6) Total risk | f) Systematic price movements that sweep most stocks along in alternating bull and bear market price swings. |
| 7) Bull and bear market | g) A period of prevailing optimism that carries the price of most securities to high levels. |
| 8) Liquidity risk | h) The aggregate variability of return an asset derives from all its risk factors. |
- 6) Indicate if the following statements are True or False:
- Price fluctuations rises results from systematic changes in the prevailing market interest rates. (True/False)
 - Most losses from default occur after the default. (True/False)
 - Price of a firm's share drop on the news of a little drop in earnings per share because it is considered a forewarning to cut in dividends and possible default and bankruptcy. (True/False)
 - A continual turnover of able executives hired into the firm from its competitors suggest that the firm suffers from lack of management depth.
 - Consumption by top-level executives of excessive amounts of non-pecuniary benefits such as expensive chauffeur-driven cars, private plane services, luxurious meetings scheduled at glamour spots, and special residences is all evidence of agency costs. (True/False)
 - About 70 per cent of the shares listed on the BSE declined in Price, on average, during the recent bull market. (True/False)
 - An investor would earn real rate of return only when his portfolio rises steadily. (True/False)
 - Purchasing power risk can be minimised by seeking securities with high positive nominal rates of return. (True/False)

2.14 FURTHER READINGS

Curley, Anthony J., and Bear, Robert M., 1979, *Investment Analysis and Management*, New York : Harper & Row.

Altman, Edward I., 1983, *Corporate Financial Distress*, New York : Wiley.

Harlow, J. Henemen, 1970, *Reading in Financial Analysis*, Ind. Ed. Homewood III :Richard D. Irwin.

Henderson; Richard., 1980, *Performance Appraisal.*, Reston, Va Reston Publishing.
Sprinckel, Bery W., 1964, *Money and Stock Prices.*, Homewood III. : Richard D. Irwin.

Fisher, Donald E., and Jordan, Ronald J., 1990, *Security Analysis and Portfolio Management*, 4th Ed., New Delhi : Prentice Hall of India Pvt. Ltd



Appendix 1: Computation of Beta (for illustrative purpose only)

| Week | BSE-100 | HLL | Infosys | Reliance | WEEKLY RETURN | | | |
|-----------|---------|--------|---------|----------|---------------|-------|---------|----------|
| | | | | | BSE-100 | HLL | Infosys | Reliance |
| 30-Jun-00 | 2397.06 | 283.64 | 8318.85 | 340.90 | | | | |
| 7-Jul-00 | 2477.20 | 278.50 | 8483.05 | 362.40 | 0.03 | -0.02 | 0.02 | 0.06 |
| 14-Jul-00 | 2432.76 | 294.50 | 7731.80 | 359.90 | -0.02 | 0.06 | -0.09 | -0.01 |
| 21-Jul-00 | 2243.63 | 258.00 | 7267.10 | 341.95 | -0.08 | -0.13 | -0.06 | -0.05 |
| 28-Jul-00 | 2153.46 | 236.10 | 6954.05 | 340.80 | -0.04 | -0.09 | -0.04 | 0.00 |
| 4-Aug-00 | 2075.15 | 255.35 | 6288.00 | 329.20 | -0.04 | 0.08 | -0.10 | -0.03 |
| 11-Aug-00 | 2092.83 | 232.40 | 7255.45 | 328.85 | 0.01 | -0.09 | 0.14 | 0.00 |
| 18-Aug-00 | 2185.65 | 243.60 | 7966.65 | 336.50 | 0.04 | 0.05 | 0.09 | 0.02 |
| 25-Aug-00 | 2260.12 | 241.75 | 8079.25 | 333.75 | 0.03 | -0.01 | 0.01 | -0.01 |
| 1-Sep-00 | 2306.07 | 238.55 | 8373.15 | 337.05 | 0.02 | -0.01 | 0.04 | 0.01 |
| 8-Sep-00 | 2390.36 | 249.25 | 8555.30 | 373.95 | 0.04 | 0.04 | 0.02 | 0.10 |
| 15-Sep-00 | 2297.93 | 240.50 | 8507.90 | 364.90 | -0.04 | -0.04 | -0.01 | -0.02 |
| 22-Sep-00 | 2037.32 | 218.00 | 7018.80 | 334.75 | -0.12 | -0.10 | -0.19 | -0.09 |
| 29-Sep-00 | 2075.67 | 208.65 | 7343.60 | 342.60 | 0.02 | -0.04 | 0.05 | 0.02 |
| 6-Oct-00 | 2050.29 | 214.25 | 7389.65 | 340.20 | -0.01 | 0.03 | 0.01 | -0.01 |
| 13-Oct-00 | 1866.40 | 184.65 | 6479.75 | 317.55 | -0.09 | -0.15 | -0.13 | -0.07 |
| 20-Oct-00 | 1885.39 | 173.15 | 7099.45 | 295.85 | 0.01 | -0.06 | 0.09 | -0.07 |
| 27-Oct-00 | 1922.73 | 168.55 | 7200.75 | 304.15 | 0.02 | -0.03 | 0.01 | 0.03 |
| 3-Nov-00 | 2009.27 | 184.45 | 7578.80 | 314.00 | 0.04 | 0.09 | 0.05 | 0.03 |
| 10-Nov-00 | 2014.02 | 187.00 | 7831.30 | 312.00 | 0.00 | 0.01 | 0.03 | -0.01 |
| 17-Nov-00 | 2010.20 | 182.25 | 7637.20 | 310.20 | 0.00 | -0.03 | -0.03 | -0.01 |
| 24-Nov-00 | 2004.56 | 172.50 | 7442.20 | 313.20 | 0.00 | -0.05 | -0.03 | 0.01 |
| 1-Dec-00 | 2101.65 | 193.95 | 7264.75 | 328.40 | 0.05 | 0.12 | -0.02 | 0.05 |
| 8-Dec-00 | 2185.11 | 192.25 | 7388.10 | 338.80 | 0.04 | -0.01 | 0.02 | 0.03 |
| 15-Dec-00 | 2144.12 | 192.50 | 7175.55 | 338.05 | -0.02 | 0.00 | -0.03 | 0.00 |
| 22-Dec-00 | 1981.98 | 200.60 | 5796.40 | 338.40 | -0.08 | 0.04 | -0.21 | 0.00 |
| 29-Dec-00 | 2032.20 | 206.35 | 5705.55 | 339.00 | 0.03 | 0.03 | -0.02 | 0.00 |
| 5-Jan-01 | 2164.50 | 208.40 | 6381.50 | 364.65 | 0.06 | 0.01 | 0.11 | 0.07 |
| 12-Jan-01 | 2072.28 | 200.85 | 5797.95 | 354.30 | -0.04 | -0.04 | -0.10 | -0.03 |
| 19-Jan-01 | 2182.09 | 200.00 | 6778.90 | 368.75 | 0.05 | 0.00 | 0.16 | 0.04 |
| 26-Jan-01 | 2217.24 | 206.25 | 6777.80 | 381.45 | 0.02 | 0.03 | 0.00 | 0.03 |
| 2-Feb-01 | 2213.88 | 199.35 | 6860.20 | 394.35 | 0.00 | -0.03 | 0.01 | 0.03 |
| 9-Feb-01 | 2266.38 | 213.50 | 6406.15 | 398.15 | 0.02 | 0.07 | -0.07 | 0.01 |
| 16-Feb-01 | 2219.68 | 216.25 | 6254.15 | 423.75 | -0.02 | 0.01 | -0.02 | 0.06 |
| 23-Feb-01 | 2083.91 | 216.35 | 5598.55 | 409.70 | -0.06 | 0.00 | -0.11 | -0.03 |
| 2-Mar-01 | 2021.59 | 232.40 | 4939.85 | 417.45 | -0.03 | 0.07 | -0.13 | 0.02 |
| 9-Mar-01 | 1885.24 | 221.55 | 4817.50 | 405.55 | -0.07 | -0.05 | -0.03 | -0.03 |
| 16-Mar-01 | 1794.12 | 220.00 | 4694.20 | 384.40 | -0.05 | -0.01 | -0.03 | -0.05 |
| 23-Mar-01 | 1714.54 | 215.55 | 4220.40 | 379.10 | -0.05 | -0.02 | -0.11 | -0.01 |
| 30-Mar-01 | 1691.71 | 218.75 | 4082.90 | 390.90 | -0.01 | 0.01 | -0.03 | 0.03 |
| 6-Apr-01 | 1658.60 | 219.95 | 4008.75 | 382.15 | -0.02 | 0.01 | -0.02 | -0.02 |
| 13-Apr-01 | 1472.93 | 210.95 | 2849.85 | 295.85 | -0.12 | -0.04 | -0.34 | -0.26 |
| 20-Apr-01 | 1704.43 | 210.00 | 3840 | 360.00 | 0.15 | 0.04 | 0.30 | 0.20 |
| 27-Apr-01 | 1624.76 | 210.40 | 3236.50 | 347.85 | -0.05 | -0.04 | -0.17 | -0.03 |
| 4-May-01 | 1710.82 | 210.35 | 3813.50 | 342.70 | 0.05 | 0.00 | 0.16 | -0.01 |
| 11-May-01 | 1716.15 | 210.05 | 3902.40 | 356.15 | 0.00 | 0.00 | 0.02 | 0.04 |
| 18-May-01 | 1766.47 | 207.50 | 3942.05 | 373.90 | 0.03 | -0.01 | 0.01 | 0.05 |
| 25-May-01 | 1782.01 | 199.90 | 4177.35 | 394.70 | 0.01 | -0.04 | 0.06 | 0.05 |
| 1-Jun-01 | 1734.90 | 192.65 | 3746.90 | 380.05 | -0.03 | -0.04 | -0.11 | -0.04 |
| 8-Jun-01 | 1706.75 | 186.65 | 3954.00 | 370.30 | -0.02 | -0.03 | 0.05 | -0.03 |
| 15-Jun-01 | 1642.94 | 198.50 | 3401.90 | 357.65 | -0.04 | 0.06 | -0.15 | -0.03 |
| 22-Jun-01 | 1620.20 | 204.70 | 3439.75 | 341.90 | -0.01 | 0.03 | 0.01 | -0.05 |
| 29-Jun-01 | 1630.02 | 205.35 | 3761.35 | 369.50 | 0.01 | 0.00 | 0.09 | 0.08 |
| Beta | | | | | 0.49 | 1.82 | 0.96 | |

Appendix 2: BSE-100 Index Closing Prices from January 90 to September 2001



| Date | BSE-100 | Date | BSE-100 | Date | BSE-100 |
|-------------|---------|-------------|---------|-------------|---------|
| 01-Jan-1990 | 423.57 | | | | |
| 31-Jan-1990 | 380.34 | 31-Jan-1994 | 1918.70 | 29-Jan-1998 | 1401.38 |
| 28-Feb-1990 | 374.60 | 28-Feb-1994 | 2055.19 | 27-Feb-1998 | 1568.83 |
| 30-Mar-1990 | 420.62 | 31-Mar-1994 | 1829.53 | 31-Mar-1998 | 1697.14 |
| 30-Apr-1990 | 422.11 | 29-Apr-1994 | 1810.24 | 30-Apr-1998 | 1760.96 |
| 31-May-1990 | 430.05 | 31-May-1994 | 1834.02 | 29-May-1998 | 1644.14 |
| 29-Jun-1990 | 444.78 | 30-Jun-1994 | 1937.70 | 30-Jun-1998 | 1427.23 |
| 30-Jul-1990 | 558.69 | 29-Jul-1994 | 1981.79 | 31-Jul-1998 | 1416.67 |
| 30-Aug-1990 | 637.23 | 31-Aug-1994 | 2149.85 | 31-Aug-1998 | 1310.60 |
| 27-Sep-1990 | 706.94 | 30-Sep-1994 | 2038.45 | 30-Sep-1998 | 1379.78 |
| 31-Oct-1990 | 640.96 | 31-Oct-1994 | 2021.66 | 30-Oct-1998 | 1260.78 |
| 30-Nov-1990 | 585.93 | 30-Nov-1994 | 1959.56 | 30-Nov-1998 | 1254.10 |
| 24-Dec-1990 | 528.51 | 23-Dec-1994 | 1863.76 | 31-Dec-1998 | 1359.03 |
| 31-Jan-1991 | 501.71 | 31-Jan-1995 | 1737.91 | 29-Jan-1999 | 1461.52 |
| 28-Feb-1991 | 607.35 | 28-Feb-1995 | 1658.99 | 27-Feb-1999 | 1506.95 |
| 27-Mar-1991 | 589.48 | 31-Mar-1995 | 1605.57 | 31-Mar-1999 | 1651.37 |
| 30-Apr-1991 | 623.03 | 28-Apr-1995 | 1524.23 | 29-Apr-1999 | 1449.64 |
| 30-May-1991 | 657.44 | 31-May-1995 | 1562.38 | 31-May-1999 | 1714.02 |
| 28-Jun-1991 | 628.75 | 30-Jun-1995 | 1530.06 | 30-Jun-1999 | 1790.51 |
| 25-Jul-1991 | 754.29 | 31-Jul-1995 | 1598.95 | 30-Jul-1999 | 1988.06 |
| 30-Aug-1991 | 855.36 | 31-Aug-1995 | 1534.37 | 31-Aug-1999 | 2192.94 |
| 27-Sep-1991 | 880.63 | 29-Sep-1995 | 1585.89 | 30-Sep-1999 | 2213.33 |
| 31-Oct-1991 | 888.39 | 31-Oct-1995 | 1554.51 | 29-Oct-1999 | 2071.50 |
| 29-Nov-1991 | 902.81 | 30-Nov-1995 | 1372.00 | 30-Nov-1999 | 2253.29 |
| 24-Dec-1991 | 893.27 | 22-Dec-1995 | 1430.75 | 30-Dec-1999 | 2624.49 |
| 31-Jan-1992 | 1074.97 | 31-Jan-1996 | 1343.21 | 31-Jan-2000 | 2875.37 |
| 28-Feb-1992 | 1246.19 | 29-Feb-1996 | 1569.67 | 29-Feb-2000 | 3293.29 |
| 31-Mar-1992 | 1967.71 | 29-Mar-1996 | 1549.25 | 31-Mar-2000 | 2902.20 |
| 30-Apr-1992 | 1705.29 | 30-Apr-1996 | 1734.11 | 28-Apr-2000 | 2396.22 |
| 29-May-1992 | 1331.07 | 31-May-1996 | 1695.55 | 31-May-2000 | 2156.99 |
| 26-Jun-1992 | 1336.75 | 28-Jun-1996 | 1743.96 | 30-Jun-2000 | 2397.06 |
| 31-Jul-1992 | 1236.28 | 31-Jul-1996 | 1612.09 | 31-Jul-2000 | 2153.26 |
| 28-Aug-1992 | 1337.32 | 30-Aug-1996 | 1587.55 | 31-Aug-2000 | 2306.07 |
| 30-Sep-1992 | 1469.18 | 30-Sep-1996 | 1449.84 | 29-Sep-2000 | 2075.67 |
| 30-Oct-1992 | 1274.42 | 31-Oct-1996 | 1409.10 | 31-Oct-2000 | 1916.99 |
| 30-Nov-1992 | 1154.04 | 29-Nov-1996 | 1284.04 | 30-Nov-2000 | 2061.18 |
| 24-Dec-1992 | 1184.60 | 24-Dec-1996 | 1363.38 | 29-Dec-2000 | 2032.20 |
| 29-Jan-1993 | 1215.18 | 31-Jan-1997 | 1481.71 | 31-Jan-2001 | 2209.31 |
| 27-Feb-1993 | 1209.58 | 28-Feb-1997 | 1584.50 | 28-Feb-2001 | 2139.72 |
| 31-Mar-1993 | 1021.40 | 31-Mar-1997 | 1463.69 | 30-Mar-2001 | 1691.71 |
| 30-Apr-1993 | 965.24 | 30-Apr-1997 | 1646.05 | 30-Apr-2001 | 1682.01 |
| 31-May-1993 | 1019.32 | 30-May-1997 | 1612.20 | 31-May-2001 | 1763.35 |
| 30-Jun-1993 | 1039.13 | 30-Jun-1997 | 1827.43 | 29-Jun-2001 | 1630.02 |
| 30-Jul-1993 | 1087.70 | 31-Jul-1997 | 1873.68 | 31-Jul-2001 | 1564.46 |
| 30-Aug-1993 | 1242.69 | 29-Aug-1997 | 1694.76 | 31-Aug-2001 | 1534.73 |
| 30-Sep-1993 | 1305.70 | 30-Sep-1997 | 1692.32 | 28-Sep-2001 | 1312.50 |
| 29-Oct-1993 | 1280.74 | 30-Oct-1997 | 1694.55 | | |
| 26-Nov-1993 | 1540.66 | 28-Nov-1997 | 1543.10 | | |
| 24-Dec-1993 | 1613.64 | 31-Dec-1997 | 1586.60 | | |