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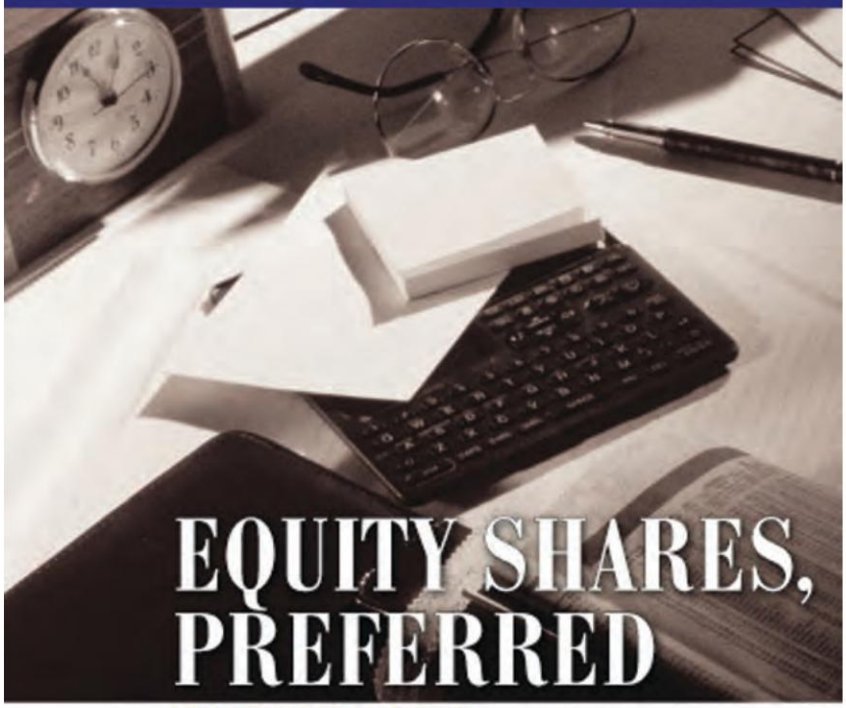

EQUITY SHARES, PREFERRED SHARES AND STOCK MARKET INDICES

McGraw-Hill Education: *Securities Markets Series*

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EQUITY SHARES, PREFERRED SHARES AND STOCK MARKET INDICES

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To
my parents
Savitri Parameswaran
and
Late A.S. Parameswaran

Contents

Preface

This is the fourth volume of the series on Securities Markets. It covers the fundamentals of two key financial securities, namely equity shares and preferred shares. The first chapter covers the key features of these instruments and analyses the impact of various corporate actions such as stock splits, stock dividends, and rights issues.

The second chapter applies the principles of time value of money to value shares using dividend discount models. The essentials of Gordon's growth model, the two-stage, the three-stage, and the H model are expounded.

Margin trading and short selling are the focus of attention of the third chapter. Since the Indian market is still evolving, the focus is on the underlying principles viewed from an international perspective.

The last chapter covers stock market indices. The methods of computation of price weighted, value weighted, and equally weighted indices are elaborated upon. The formation of tracking portfolios to mimic various indices is also presented.

The contents of the book have been used at business schools as well as for corporate training programmes, and consequently are a blend of academic rigour and practical insights. It will appeal to market professionals, as well as student, who wish to build foundation in financial theory, in general and securities markets in particular.

Sunil K. Parameswaran

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Sunil K. Parameswaran

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1
CHAPTER

Equity Shares and Preferred Shares

INTRODUCTION

EQUITY SHARES OR SHARES OF a company's common stock are financial claims issued by the firm, which confer ownership rights on the holders. A share of stock represents the fundamental unit of ownership of a corporation, and all firms have at least one shareholder. Most modern corporations have a large number of shares outstanding; their ownership is spread over a vast pool of investors. Every shareholder is a part owner of the company. A shareholder's stake in the firm is equal to the fraction of the total share capital of the firm to which he has subscribed.

When a firm is incorporated, a stated number of shares will be authorised for issue. The value of such shares is called the *authorised capital* of the firm. It is not, however, necessary that all the authorised shares be issued immediately. A portion of these may be held in reserve for issue at a later date, should the firm require additional

funds at that time. The value of shares that are actually issued is called the *issued capital*.

When a firm makes a profit, it will typically pay out a percentage of it in the form of cash to its shareholders. This income received from the firm is called a *dividend*. In practice, a firm will rarely pay out its entire profit for the year as dividends. A part of the profits will be ploughed back into the venture to meet future requirements. The profits that are reinvested in the firm are called *retained earnings*. The earnings that are retained in a particular year will manifest themselves as an increase in the Reserves and Surplus account on the balance sheet of the firm.

Shareholders are considered residual claimants in two ways. Firstly, they are eligible for dividends only after all payments due to the firm's creditors have been made. The rate of dividends is consequently not fixed and nor is the payment of dividends contractually guaranteed. In other words, a shareholder cannot demand a dividend as a matter of right. The decision as to whether dividends should be paid in a particular year and the quantum of such dividends are decided by the Directors of the firm. Shareholders therefore indirectly influence the dividend policy of the firm by electing the Directors. They are residual claimants from another point of view as well. If the firm were to declare bankruptcy, then the shareholders would be entitled only to the residual value of the assets after the claims of all the other creditors have been settled.

Equity shares have no maturity date. Thus they continue to be in existence as long as the firm itself. A key feature of a company as opposed to a sole proprietorship or a partnership is that the shareholders have limited liability.

This means that no matter how serious the financial difficulties faced by a company, neither it nor its creditors can make financial demands on the common shareholders. Thus, the maximum financial loss that a shareholder may suffer is limited to his investment while acquiring the shares.

VOTING RIGHTS

Equity shares carry voting rights, including the right to elect the Directors of the company. The most common arrangement is one vote per common share. However in practice, shares with differential voting rights can be issued. Such categories of shares are usually otherwise similar to normal shares in the sense that the holders of such shares have an unlimited right to participate in the earnings of the corporation. They also have a right on the assets of the company upon liquidation, after all the other creditors and prioritised security holders.

For example, the Ford Motor Company has two classes of shares. The shares available to the public have voting rights. As of 1998, there were more than a billion Ford shares outstanding. But of these 70.9 million were Class B shares owned by the Ford family and certain key officers. These shares have weighted voting rights that allow them to control nearly 40% of the votes. These shares have always voted as a unified block. Thus the majority of shareholders cannot force a decision easily on the company.[1]

Proxies

The right to vote is conferred on individuals who are the shareholders *of record*. Only a person who is listed on the

corporation's register of shareholders as of the *record date* is an eligible shareholder. The record date is usually prior to the date of the meeting at which the actual voting will take place. It is possible that a person whose name is in the register on the record date could sell his shares prior to the date of the meeting. In such cases, the new owner (whose name will not appear on the register) cannot vote unless the seller of the shares gives him a proxy.

In any case only a small percentage of the shareholders of large companies may be realistically expected to attend the annual meetings. For the benefit of those who are unable to attend, companies send a proxy statement and a ballot, prior to the scheduled date of the meeting. The shareholder is expected to mark his preferences and return the ballot before the meeting. A typical proxy statement typically includes information on the individuals seeking appointment or re-appointment as directors, and details of any resolutions for which the opinion of the shareholders is required. The ballots will be collated and a person appointed by the firm will cast the votes as directed by the absentee shareholders.

There are practical reasons why managements solicit proxies from shareholders. Usually, a *quorum* is required in the form of shares represented at the meeting, either by the owners in person or by proxies, before any business can be transacted.

PAR VALUE VERSUS BOOK VALUE

Common stock usually has a par value (also known as face value or stated value). The par value has no practical

significance and values in the US can be fixed at arbitrary levels like 10 cents. One of the reasons for the issue of low par value stock is that in some states in the US, the incorporation fees that are charged are based on the par value of the shares being registered. Hence, such fees can be minimised by assigning low par values. In India, the minimum par value is Re 1. We also observe par values of Rs. 2, Rs. 5, and Rs. 10.

The book value of a share is the value of the assets behind a share, as per the balance sheet. It is found by adding up the par value and the retained earnings and dividing by the number of shares outstanding. In practice, the book value of a share could be very different from its market value, which is the value assigned to the share by the stock market.

DIVIDENDS

The shareholders of a company cannot demand dividends from it. The decision to pay dividends is entirely at the discretion of the board of Directors of the company.

In a dividend payment, four dates are important. The first is called the *declaration date*. It is the date on which the decision to pay a dividend is declared by the Directors of the company, and the amount of the dividend is announced. The dividend announcement will mention a second date called the *record date*. Only those shareholders whose names appear as of the record date on the register of shareholders being maintained by the company, will be eligible to receive the forthcoming dividend.

A third important date is the *ex-dividend date*. It is specified by the exchange on which the shares are traded. An

investor who purchases shares on or after the ex-dividend date will not be eligible to receive the forthcoming dividend. Quite obviously, the ex-dividend date will be such that transactions prior to that date will be reflected in the register of shareholders as on the record date, whereas transactions on or after that date will be reflected in the books only after the record date. Thus, the ex-dividend date will be set a few days before the share transfer book is scheduled to be closed, in order to help the share registrar complete the administrative formalities.

For instance on the NYSE, a $T + 3$ settlement cycle is followed. If a trade occurs on day T, then delivery of shares to the buyer and payment of funds to the seller occurs on day $T + 3$. Consequently, anyone who purchases shares two days before the record date or later will not be able to ensure that he is the owner of record as of that date. Hence on the NYSE, the ex-dividend date for an issue is specified as two business days prior to the record date announced by the firm.

Prior to the ex-dividend date, the share will be traded cum dividend, which implies that the buyer of the share will receive the coming dividend. On the ex-dividend date the shares begin to trade ex-dividend, which connotes that a potential buyer will no longer be eligible to receive the next dividend if he were to acquire the share.

On the ex-dividend date, the share ought to in theory decline by the amount of the dividend. For instance, if the cum dividend price is Rs. 50 per share, and the quantum of the dividend is Rs. 2 per share, then from a theoretical standpoint, the share should trade at Rs. 48 ex-dividend.

Finally we have a date called the *distribution date*, which is the date on which the dividends are actually paid or distributed.

Stock Dividends

A stock dividend (called a *bonus share* in India) is one that is distributed in the form of shares of stock rather than as cash. The issue of additional shares without any monetary consideration entails the transfer of funds from the reserves and surplus account to the share capital account. This is known as the *capitalisation of reserves.*

From a theoretical standpoint, bonus shares do not create any value for an existing shareholder.

Example 1.1

For instance, assume that a shareholder owns 500 shares of a firm, which has issued a total of 500,000 shares, making his share $\frac{1}{1000}$th of the firm. If the firm announces a 10% stock dividend, or one additional share for every existing ten shares, it will have to issue 50,000 shares, of which this investor will receive 50. Thus, after the issue of the additional shares, he will be in possession of 550 shares, which is $\frac{1}{1000}$th of the total number of shares (that is 550,000). His stake in the company will therefore remain unaltered.[2]

From the company's point of view, the issue of additional shares does not amount to any change in its asset base or earning capacity. So the share price should theoretically decline after a stock dividend is declared.

Assume that the share price prior to the bonus issue was Rs. 55 per share in Example 1.1. The ex-bonus price P, should be such that

$$500{,}000 \times 55 = 550{,}000 \times P$$
$$\Rightarrow \qquad P = 50$$

A stock dividend is usually declared when a firm wants to reward its shareholders without a concomitant outflow of cash. The reason for this could either be that the firm is short of funds, or it requires the available cash for productive investments.

Sometimes, a company may declare a bonus issue prior to the payment of a cash dividend. The impact on the share price may be determined as follows.

Example 1.2

Let us assume that the same company announces a cash dividend of Rs. 2 and a bonus issue of 10%. Assume that the cash dividend will also be paid on the additional shares that are to be issued.

The cum-bonus cum dividend price is obviously Rs. 55. The market value of 500,000 shares is therefore

$$500{,}000 \times 55 = 27{,}500{,}000$$

The market value of 550,000 ex-bonus cum dividend shares will be Rs. 27,500,000, since the bonus issue by itself does not add any value. Thus, the theoretical price of ex-bonus ex-dividend shares will be

$$\frac{27{,}500{,}000 - 2 \times 550{,}000}{550{,}000} = \text{Rs. } 48$$

Treasury Stock

The term *Treasury stock* refers to shares which were once issued to the public but have subsequently been reacquired

by the company either through an open market purchase or by way of a tender offer.

These shares have no voting rights, receive no dividends, and are not used in the computation of earnings per share. Companies can reissue such shares for Employee Stock Option Plans (ESOPs), etc.

One reason for repurchasing shares could be that the Directors of the firm feel that the market is undervaluing the firm's stock. A buy back programme can help prop up the price of the shares. It will also serve to increase the earnings per share and reduce the total amount of dividends that the company needs to declare. Sometimes companies repurchase shares as a means of thwarting the intentions of financiers who plan to liquidate the firm. There are such corporate raiders who acquire voting control in companies and sell its assets piece by piece to competitors. By stashing away treasury stock, management can acquire greater control. There are also situations where a company is generating more cash flows than it can profitably reinvest. One way of dealing with such a situation is by paying special extra dividends. But this will automatically have tax implications. In such cases, a repurchase plan may be a better way of returning capital to the shareholders.

SPLITS AND REVERSE SPLITS

An n:1 stock split means that n new shares will be issued to the existing shareholders in lieu of one existing share. For instance a 11:10 split means that a holder of ten existing shares will receive 11 shares. Thus, this stock

split is exactly analogous to a 10% stock dividend. However, stock dividends entail the capitalisation of reserves as explained earlier, whereas stock splits do not. What happens in such cases is that the par value of existing shares is reduced. Since the number of shares will increase proportionately, the product of the par value and the number of shares outstanding (which is nothing but the issued share capital) will remain unchanged after the split.

The share price after a split will behave in the same way as it would after an equivalent stock dividend. Take the case of our investor who is holding 500 shares worth Rs. 55 each. If the company were to announce a 11:10 stock split, he will have 550 shares after the split, which will theoretically be worth Rs. 50 each.

Companies generally go in for a split when their share prices become too high, and it is felt that the scrip is now out of the reach of small and medium investors. What is high is of course subjective. In practice, it is believed that most managers have a feel for what is the popular price range for their stock. In other words, they thought to be aware of the price range within which their stock should trade if it is to attract adequate attention from investors. Investors normally prefer to trade in round lots (usually defined as a bundle of 100 shares) than in odd lots (less than 100 shares). At very high share prices, small and medium investors may not be able to afford round lots.

A company which perceives its stock price to be too low can go in for a reverse split. Exchanges like the NYSE discourage the listing of securities which are consistently trading at very low prices. This is because such prices have a tendency to attract inexperienced traders with

unrealistic price expectations who could get their fingers burnt. The difference between an $n{:}m$ split and an $n{:}m$ reverse split is that in the first case, n will be greater than m whereas in the latter it will be less. For instance, assume that the company announces a 4:5 reverse split. Thus a holder of 500 shares would have 400 shares after the split. The post reverse split share price would be

$$P = \frac{500{,}000 \times 55}{400{,}000} = \text{Rs. } 68.75$$

A stock split will usually result in a reduced dividend per share. Since the number of shares outstanding after the split will be a multiple of the number of shares outstanding before the split, most companies will have no option but to reduce the per share dividend. However, in many cases companies will increase the aggregate dividends.

This means that if a company was paying a dividend of $5 per share, and it announces a 5:1 split, the post-split dividend may be fixed at $ 1.10 per share. Then the holder of a share prior to the split will be entitled to an aggregate dividend of $ 5.50 on the five shares that are in his possession after the split.

PREEMPTIVE RIGHTS

The Directors of a company must obtain the approval of existing shareholders if they wish to issue shares beyond what has been authorised earlier. As per the charter of some corporations, existing shareholders must be given the first right to buy additional shares in proportion to the shares that they already own. In such cases, existing shareholders are said to have a preemptive right to acquire new shares as and when they are issued.[3] The ex-

isting shareholders are thus given an opportunity to maintain their proportionate ownership in the company.

Often the rights issue is made at a price that is lower than the prevailing market price. If so, then the right acquires a value of its own. The existing shareholders can in this case either exercise their rights and acquire additional shares, or else sell the rights to someone else. The value of such a right is explained in the following example.

Example 1.3

Let us suppose that a company has 500,000 shares outstanding and that shareholders are entitled to purchase one new share for every ten shares that are currently being held. So in all, 50,000 shares will be issued. Let us assume that the prevailing market price is Rs. 50 per share, whereas the existing shareholders are being given the right to acquire additional shares at Rs. 39 per share. The market value of the firm prior to the rights issue is

$$500{,}000 \times 50 = 25{,}000{,}000$$

The post issue theoretical value of the firm will therefore be

$$25{,}000{,}000 + 50{,}000 \times 39 = 26{,}950{,}000$$

The ex-rights price should therefore be

$$\frac{26{,}950{,}000}{550{,}000} = 49$$

Consider that the shareholder is getting a share worth Rs. 49 at Rs. 39, the value of the right to acquire a share is Rs. 10. Since the shareholder needs ten shares to acquire the right to buy one share, the value of a right is Re 1.

At first glance it may appear that the existing shareholders are losing, since the ex-rights market price is Rs. 49

which is lower than the cum rights price of Rs. 50. However, it must be remembered that the shareholders have been given the opportunity to buy new shares at Rs. 39. This opportunity makes up for the decline in the share price.

For instance, if we take the case of a person who owns 50 shares, the value of these shares prior to the issue of rights is Rs. 2,500. If he decides to exercise his rights he can acquire five additional shares by paying Rs. 39 for each. The value of his shares after the issue is

$$49 \times 55 = 2{,}695 = 2{,}500 + 5 \times 39$$

Thus, there is no dilution in terms of value.

On the other hand, if he decides not to exercise his rights, he can renounce them in favour of another investor. The rights can then be sold for Re. 1 per right. The value of his position after renouncing the rights will be

$$49 \times 50 + 1 \times 50 = 2{,}500$$

In practice, the ex-rights price may be higher than the theoretically predicted value. This is because the rights issue may be perceived as an information signal by investors. The very fact that the company has chosen to issue additional shares may be construed as a signal of enhanced future profitability. One reason for this could be that investors believe that the new funds raised in this manner will be used for more profitable projects. Another reason could be that since cash dividends are usually maintained at existing levels in the medium term, the shareholders believe that the issue of additional shares is an indicator of greater profitability from the existing ventures of the firm. Both these factors could cause the demand for shares to rise, as a consequence of which the decline in the price will be less than what is predicted by theory.

PREFERRED SHARES

Preferred shares also represent ownership in a corporation. However, preferred shareholders may or may not having voting rights. At times, such shares receive voting rights only if dividends have not been paid for a stipulated length of time. The term *preferred* connotes the fact that such shares have certain associated privileges. These are:

- Current dividends must be paid to the preferred shareholders before any dividends can be paid to equity shareholders
- If a company is liquidated the preferred shareholders have to be paid their share (in part or in full) out of the liquidated assets before the balance if any can be paid to the equity shareholders

Preferred stocks carry a fixed rate of dividend. The rate may be expressed either in dollar terms or as a percentage. For instance, the term $ 3.50 preferred stock denotes shares carrying a dividend of $ 3.50 per share. The shares may also be described as 3.5% preferred stock with a par value of $ 100. This once again connotes a dividend of $ 3.50 per share.

Thus, from the perspective of income, preferred shares are similar to bonds and are unlike equity shares, which are subject to varying dividends. However unlike bonds, preferred stock represent ownership of the firm, and the dividend is not a legal liability. Just as in the case of equity dividends, the Directors of a firm must meet and declare each dividend that is paid.

Good quality preferred shares offer an opportunity for generous dividend return with no opportunity for growth. Capital gains can arise but these are usually caused by declining interest rates which lead to a lower required rate of return. Such gains are not due to better earnings prospects. The price of a preferred share is therefore inversely related to the prevailing rate of interest, and in this respect, it is like a bond.

Companies issue preferred shares because such instruments enable them to lock in a fixed yet flexible expense. Although a fixed dividend is payable on such stocks, the dividends can be deferred if required. Thus, in the event of financial difficulties, such shares offer critical flexibility to the firm.

Just like bonds, preferred shares provide leverage to common stockholders. That is, rising profits belong entirely to the existing equity shareholders and do not have to be shared with holders of preferred stock. However, although debt securities carry a fixed rate of interest and consequently provide leverage, the bond holders have a legal right to be paid interest and principal when such payments fall due. So deferral of such payments is not an option for the firm, no matter how difficult the conditions faced by the firm may be.

Callable Preferred Stock

In a period of high interest rates, preferred stocks have to compete with debt securities and have to offer high dividend rates. But the company may be of the opinion that this is a passing phase and that in the near future, it can issue stocks with a lower rate of dividend. If so,

the company could issue *callable* preferred stock. As the name suggests, such shares can be recalled or retired by the company at a predetermined price. Preferred shares without such an option are said to be *noncallable*.

This ability to recall the issue works against the investors, since the issue will be called back when rates fall. This is precisely when the shareholders would like to hold on to their securities. To sweeten the deal, companies offer callable shares which cannot be recalled for the first five to ten years or so. This guarantees assured returns to the shareholders for a specified period, while at the same time allowing the issuer to incorporate the call feature.

Convertible Preferred Shares

Another way of sweetening a preferred issue is by specifying a conversion option. For instance, a company may believe that its prospects are very bright in the medium to long-term and that its equity shares are therefore likely to appreciate in value. It could then issue preferred shares with an option to convert subsequently into equity at a prespecified conversion ratio. If investors feel that the conversion option is likely to be beneficial, they may accept the preferred shares at a lower rate of dividend than they would otherwise.

Example 1.4

Alpha corporation has issued preferred shares. Each share is convertible into five ordinary equity shares. Thus the conversion ratio is 5:1.

Assume that the preferred shares are currently selling at $ P_P each and that the equality shares are selling at $ P_E each.

If $P_P = 5P_E$ then the two types of stock are said to be *at parity*.

In this case assume that the preferred share is selling at $ 125 and that equity shares are selling at $ 25 each. So we have a parity situation. Once parity is reached, if the dividend of the converted shares is greater than the dividend on the preferred, then the preferred shareholders will normally convert.

If the preferred share is paying a dividend of $ 10, while the equity shares are paying a dividend of $ 2.20, the preferred shareholder would receive a total dividend of $ 11 from the five equity shares if he were to convert.

If the preferred share is worth more than the value of the converted equity shares, then it is said to trade above parity. Here, if the preferred share were to trade at $ 140 and the equity shares at $ 27 each, then the share is trading above parity.

If the perceived prospects of the company were to lead to a situation where the value of the equivalent common shares exceeds the price of the preferred, then arbitrageurs will step in, causing the price to revert to parity. For instance assume that the preferred share is trading at $ 125 and that common shares are selling at $ 27 each. An arbitrageur will buy a preferred share for $ 125 and immediately convert it into five equity shares. These shares can then be sold for $ 135. This will clearly

lead to an arbitrage profit of $ 10. As arbitrageurs do this, the price of the preferred stock will rise, while that of the equity shares will fall. Eventually the stocks will go back to parity.

Cumulative Preferred Shares

In the case of non-cumulative preferred shares, an unpaid or missed dividend is lost forever. However in the case of cumulative preferred shares, all outstanding dividends including the current dividend, must be paid before any dividends can be paid to equity holders.

Example 1.5

Convergys corporation has issued one preferred share with a dividend of $ 5 to Harry and one equity share to Sally. They are the only two shareholders. The company has a policy of paying out the entire earnings for the year as dividends. Assume that the earnings for the company over a five-year horizon are as follows.

Table 1.1

Earnings Record

Year	*Earnings*
2000	5
2001	2
2002	8
2003	0
2004	12

If the preferred share is non-cumulative, then the dividends will be distributed as follows:

Table 1.2

Dividend Distribution: The Case of Non-cumulative Shares

Year	*Earnings*	***Preferred Dividends***	***Common Dividends***
2000	5	5	0
2001	2	2	0
2002	8	5	3
2003	0	0	0
2004	12	5	7

However, if the preferred share is cumulative then the dividends will be distributed like this:

Table 1.3

Dividend Distribution: The Case of Cumulative Shares

Year	*Earnings*	***Preferred Dividends***	***Common Dividends***
2000	5	5	0
2001	2	2	0
2002	8	8	0
2003	0	0	0
2004	12	10	2

First, consider the case of the non-cumulative preferred share. In 2000, the earnings is $ 5, which is just adequate to pay the preferred dividend. There will obviously be nothing left for the equity holder. In 2001, the earnings is $ 2. The entire amount will go to the preferred shareholder. He is eligible for $ 5 but the company does not have adequate funds. Once again, the equity holder will receive nothing. In 2002, the preferred shareholder will receive $ 5. The balance $ 3 will go to the equity holder. In 2003, the company has nothing to distribute. Consequently, neither the equity holder nor the preferred shareholder will receive anything. And in 2004, the company has earnings of $ 12. It will pay $ 5 to the preferred shareholder. The balance $ 7 will be paid to the equity holder.

Now let us consider the case of the cumulative preferred share. In 2000, the earnings of $ 5 will be just adequate to pay what is owed on the preferred share. Obviously the equity share will earn nothing. In 2001, the entire earnings of $ 2 will go to the preferred share and nothing will be paid on the equity share. In 2002 the earnings is, $ 8. Only $ 5 is required to be paid for that year on the preferred share. However, there is a backlog of $ 3 from the previous year, so the entire amount of $ 8 will go to the preferred share holder. The equity holder will receive nothing. In 2003 the earnings are zero, and neither shareholder will receive anything. Finally in 2004, out of the earnings of $ 12 for the year, $ 10 will go the preferred holder. Out of this $ 5 is for that year and the balance is the arrears for the previous year. The remaining $ 2 will go to the equity shareholder.

Adjustable Rate Preferred Shares

These are similar to floating rate bonds, in the sense that the dividends are not fixed, but are subject to periodic revision based on a pre-specified formula. For instance, the dividend rate may be specified as the T-bond rate plus a spread.

Participating Preferred Shares

Such preferred shares may receive additional dividends over and above what is fixed at the outset. The extra payment may be linked to the performance of the issuing firm using a predetermined formula, and/or may be based on the decision of the board of Directors. This feature can add to the value of preferred shares. In practice, however, most preferred shares are non-participatory in nature.

ENDNOTES

1. See Teweles and Bradley(1998).
2. In the US, stock dividends are given in percentage terms. In India we usually state them in terms of a ratio. Thus, a 10% stock dividend will be stated as a 1:10 bonus issue in India.
3. In this case, we are talking about shares being issued for a monetary consideration.

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CHAPTER 2

Dividend Discount Models

INTRODUCTION

THE VALUE OF A FINANCIAL asset is a function of the size, the timing and the risk of the cash flows that accrue to the owner of the asset.

The size of the cash flow determines the quantum that has to be discounted in order to arrive at the value. The timing of the cash flow is crucial because money has time value. And finally, the risk of the cash flows is a factor for it has repercussions for the discount rate used to compute the present values of the cash flows.

The first question is, what are the cash flows for a person who is contemplating the acquisition of a stock? He will obviously receive a dividend for each period that he chooses to hold the stock.[1] Secondly, he will have an inflow on account of the sale of the stock at the end of his planned investment horizon, however long that may be.

A GENERAL VALUATION MODEL

We will use the following symbols. Additional variables will be defined as we go along.

- $P_0 \equiv$ Price of the stock at the outset
- $d_t \equiv$ Expected dividend per share at the end of period t
- $P_t \equiv$ Expected price of the stock at the end of period t
- $r \equiv$ Required rate of return for the asset class to which the stock belongs

Consider the case of an investor who plans to hold the stock for one period. Obviously

$$P_0 = \frac{d_1}{1+r} + \frac{P_1}{1+r}$$

If we assume that the person who buys the stock after one period also has a one period horizon, then

$$P_1 = \frac{d_2}{1+r} + \frac{P_2}{1+r}$$

$$\Rightarrow \qquad P_0 = \frac{d_1}{1+r} + \frac{d_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$$

Extending the logic,

$$P_0 = \frac{d_1}{1+r} + \frac{d_2}{(1+r)^2} + \frac{d_3}{(1+r)^3} + \cdots$$

$$= \sum_{t=1}^{\infty} \frac{d_t}{(1+r)^t}$$

Thus, today's stock price is nothing but the present value of an infinite stream of expected devidends.

The Constant Growth Model

In practice, no one can forecast an infinite stream of dividends. Consequently, a model is needed to specify the growth of dividends over time. The simplest approach is to assume that dividends grow at a constant rate year after year.

Assume that dividends grow at a constant rate of g% per annum, and that the last declared dividend was d_0. The current price can then be expressed as:

$$P_0 = \frac{d_0(1+g)}{1+r} + \frac{d_0(1+g)^2}{(1+r)^2} + \frac{d_0(1+g)^3}{(1+r)^3} + \cdots$$

$$\Rightarrow \quad \frac{P_0(1+r)}{(1+g)} = d_0 + \frac{d_0(1+g)}{1+r} + \frac{d_0(1+g)^2}{(1+r)^2} + \cdots$$

$$\Rightarrow \quad \frac{P_0}{1+g}[r-g] = d_0$$

$$\Rightarrow \quad P_0 = \frac{d_0(1+g)}{r-g} = \frac{d_1}{r-g}$$

This is called the constant growth model or the Gordon growth model.

Example 2.1

Flextronics has just paid a dividend of Rs. 2.50 per share. The required rate of return on the stock is 10% per annum, and dividends are expected to grow at the rate of 6% per annum. What should be the stock price?

The price as per the Gordon model is

$$P_0 = \frac{d_0(1+g)}{r-g} = \frac{2.50(1.06)}{0.10 - 0.06}$$

$$= \text{Rs. } 66.25$$

The Two-Stage Model

The constant growth model assumes a growth rate that stays constant forever. The two-stage model assumes that the stock will display a high growth rate of g_a% per annum for the first A years, and that it will then settle down to a more modest level of g_n% that will last for ever thereafter. The price of the stock under these assumptions may be then determined as follows.

$$P_0 = \frac{d_1}{1+r} + \frac{d_2}{(1+r)^2} + \cdots + \frac{d_A}{(1+r)^A} + \frac{d_{A+1}}{(1+r)^A (r-g_n)}$$

$$= \frac{d_0(1+g_a)}{1+r} + \frac{d_0(1+g_a)^2}{(1+r)^2} + \cdots + \frac{d_0(1+g_a)^A}{(1+r)^A}$$

$$+ \frac{d_0(1+g_a)^A}{(1+r)^A} \frac{(1+g_n)}{r-g_n}$$

Let $S = \dfrac{d_0(1+g_a)}{1+r} + \dfrac{d_0(1+g_a)^2}{(1+r)^2} + \cdots + \dfrac{d_0(1+g_a)^A}{(1+r)^A}$

$$\Rightarrow \quad S = \frac{d_1}{r-g_a}\left[1 - \frac{(1+g_a)^A}{(1+r)^A}\right]$$

$$\Rightarrow \quad P_0 = \frac{d_1}{r-g_a}\left[1 - \frac{(1+g_a)^A}{(1+r)^A}\right] + \frac{d_1(1+g_a)^A}{(1+r)^A}\frac{(1+g_n)}{r-g_n}$$

$$\times \frac{1}{(1+g_a)}$$

$$= \frac{d_1}{r-g_a}\left[1 - \left(\frac{1+g_a}{1+r}\right)^{A-1}\frac{(g_a-g_n)}{r-g_n}\right]$$

Example 2.2

Flextronics has just paid a dividend of Rs. 2.50 per share. Dividends are expected to grow at the rate of 12% per annum for the first five years, and then at a constant rate of 6% per annum thereafter. The required rate of return on the stock is 10%. What should be the price of the stock as per the two-stage model?

$$P_0 = \frac{2.50(1.12)}{.10 - .12}\left[1 - \left(\frac{1.12}{1.10}\right)^4 \left(\frac{.12 - .06}{.10 - .06}\right)\right]$$
$$= -140\,[1 - 1.6121] = \text{Rs. } 85.69$$

The Three-Stage Model

One of the shortcomings of the two-stage model is that the growth rate suddenly declines at the end of the high growth phase. The three-stage model avoids this kind of a discrete jump by postulating that dividends grow at a high rate during an initial period, and that the growth rate then declines linearly year after year during an intermediate phase, till it reaches a stable value that then remains constant. If we denote the duration of the high growth phase as A years, and the duration of the declining growth phase as $B - A$ years, then the model may be expressed as

$$P_0 = \sum_{t=1}^{A} \frac{d_1(1 + g_a)^{t-1}}{(1 + r)^t} + \sum_{t=A+1}^{B} \frac{d_{t-1}(1 + g_t)}{(1 + r)^t} + \frac{d_B(1 + g_n)}{(1 + r)^B(r - g_n)}$$

where $g_t = g_a - (g_a - g_n)\,\dfrac{t - A}{B - A}$ during the period $(A + 1) \le t \le B$.

EXAMPLE 2.3

Flextronics has just paid a dividend of Rs. 2.50 per share. Dividends are expected to grow at a rate of 12% per annum for the first five years. The growth rate is then expected to decline linearly for five years till it reaches a rate of 6% per annum. The rate is then expected to remain at 6% per annum thereafter. The required rate of return on the stock is 10%. What is the value of the stock as per the three-stage model?

Table 2.1
Valuation of Cash Flows as per the Three-Stage Model

Year	*Dividend*	*Present Value*
1	2.8000	2.5455
2	3.1360	2.5917
3	3.5123	2.6388
4	3.9338	2.6868
5	4.4059	2.7357
6	4.8817	2.7556
7	5.3503	2.7455
8	5.7998	2.7056
9	6.2173	2.6367
10	6.5903	2.5408

$$\frac{d_{10}(1+g_n)}{(r-g_n)(1+r)^{10}} = \frac{6.5903 \times 1.06}{(0.04)(1.10)^{10}}$$

$$= 67.3324$$

$$P_0 = \text{Rs. } 93.92$$

The H Model

The H model is an alternative to the three-stage model. Here too, growth begins at a high rate of g_a% per annum. However, there is no initial high growth period. Rather, the growth rate declines linearly from the outset over a period of 2 H years till it reaches a value of g_n% per annum. Thereafter the growth rate remains constant. The value of the share as per this model is given by

$$P_0 = \frac{d_0}{r - g_n}[(1 + g_n) + H(g_a - g_n)]$$

Example 2.4

Flextronics has just declared a dividend of Rs. 2.50 per share. The initial growth rate is 12% per annum, and is expected to decline linearly over a period of ten years till it reaches 6% per annum. The rate of growth will then remain at 6% forever. The required rate of return on the stock is 10%. What is the price of the stock as per the H model?

2 H = 10 years $\Rightarrow$ H = 5 years

$$P_0 = \frac{2.50}{.10 - .06}[(1.06) + 5(.12 - .06)]$$

$$= \frac{2.50}{0.04} \times 1.36 = \text{Rs. } 85$$

Exercises

1. Mirage Ltd. has just declared a dividend of Rs. 4 per share. Dividends are expected to grow at a constant rate of 5% per annum. The required rate of return on

the stock is 8% per annum. What should be the price of the stock?

2. Caledonian Corporation has just declared a dividend of $ 2.25 per share. Dividends are expected to grow at a rate of 8% per year for the first four years. Thereafter, the dividends are expected to grow at a constant rate of 5% per annum forever. The required rate of return on the stock is 10% per annum. What should be the price of the stock?
3. Turner Morrison has just declared a dividend of Rs. 4 per share. Dividends are expected to grow at a rate of 8% per annum for four years. They are then expected to decline linearly to a rate of 4% per annum, over a period of four years. Then the growth rate will remain at 4% forever. The required rate of return on the stock is 6%. What should be the price of the stock?
4. GST Corporation has just declared a dividend of Rs. 4 per share. The current growth rate of dividends is 10% per annum. The growth rate is expected to declare linearly to 4% per annum over a period of six years. The required rate of return on the stock is 8% per annum. What should be the price of the stock?

ENDNOTES

1. While this is true in general, there could be periods where the firm decides not to pay a dividend.

CHAPTER 3

Margin Trading and Short Selling: An International Perspective

INTRODUCTION

THE TERM *BUYING STOCK ON margin*, refers to the acquisition of the stock by borrowing a part of the funds required for purchase from the broker. Consequently, when an investor acquires a stock on margin, he can purchase a greater number of shares than the funds at his disposal would otherwise permit.

In order to indulge in margin trading, a separate margin account would have to be set up. Margin trading cannot therefore be undertaken in a normal cash account.[1]

TERMINOLOGY

The percentage of the market value of the securities that has to be deposited by the customer is called the *margin rate*. The difference between the current market value of the securities and the amount that has to be deposited by the customer is called the *loan value*. This represents the maximum amount that can be borrowed from the broker. The loan rate is the loan value expressed as a fraction of the market value. The loan rate plus the margin rate will therefore, be equal to 100%. The actual amount borrowed from the broker is called the *broker's loan* or *debit balance*, signifying that the investor owes that much to the broker. Sometimes, instead of borrowing from the broker, the client may have surplus funds in the account. In such a case it would be referred to as a *credit balance*. The difference between the market value and the debit balance is called the *owner's equity*. It is what the investor is entitled to if the position were to be liquidated. If there were to be a credit balance in the account, then the owner's equity would be equal to the sum of the market value plus the credit balance.

EXAMPLE 3.1

A client wants to purchase 100 shares of IBM stock, which is currently trading at $ 100 per share. The margin rate is 60%, and the client wants to invest the minimum amount that is permitted by regulations.

The market value of 100 shares is $ 10,000. Since the margin rate is 60%, a minimum of $ 6,000 has to be deposited by the investor. Thus, a maximum of $ 4,000 can be borrowed from the broker. Thus the loan value of the position is $ 4,000, and the loan rate is 40%. Let us assume that the client deposits $ 6,000. If so his equity is $ 6,000 and the debit balance in the account is $ 4,000.

Now let us assume that the share price increases to $ 130. The market value of the securities will be $ 13,000. The debit balance will continue to be $ 4,000, but the owner's equity will increase to $ 9,000. As per the requirement, the owner's equity must be at least $ 7,800. The loan value is now $ 5,200. The difference between the loan value and the debit balance is called the *excess*. The excess can be withdrawn or else used to acquire more securities.

If the client withdraws the excess, which is $ 1,200 in this case, the owner's equity will decline to $ 7,800 and the debit balance will rise to $ 5,200. This is consistent with the stipulation that a maximum of 40% of the market value of the securities can be borrowed. However, if the investor were to choose to use this amount of $ 1,200 to buy additional securities, he could buy securities worth

$$\frac{1{,}200}{0.60} = \$\ 2{,}000$$

If he were to do so, the market value of the securities would be

$$\$\ 13{,}000 + \$\ 2{,}000 = \$\ 15{,}000$$

The debit balance would be $ 6,000, since the entire additional purchase would be financed by borrowing from the broker. The owner's equity would continue to remain at $ 9,000, which is consistent with the stipulation that a minimum of 60% of the market value of the securities ought to be paid for by the investor.

The excess of $ 1,200 therefore represents the ability to buy additional securities worth $ 2,000. This is called the *buying power*. Thus, the buying power of a position may be defined as:

$$\text{Buying Power} = \frac{\text{Excess equity}}{\text{Margin rate}}$$

MARGIN TRADING

EXAMPLE 3.2

Take the case of an investor Michael, who has $ 10,000 at his disposal, and assume that he is desirous of acquiring shares of IBM, which are currently available at a price of $ 100 each. The margin rate is 50%.

If he were to trade on a cash basis, he could acquire 100 shares of stock. However, if he were to trade on margin, he could borrow up to a maximum of $ 10,000 and consequently purchase 200 shares.[2]

What is the advantage of margin trading? Margin trading allows the investor to obtain *leverage*. This term refers to the ability to magnify the return on invested capital, using borrowed funds to partly finance the purchase of the asset. However, leverage is a double-edged sword. Hence, while positive returns get magnified, so do negative returns. In other words, while the percentage of profits gets inflated in the event of a profit, so do the losses, if there is an adverse market movement.

Continuing with the example, let us first assume that he chooses to trade on a cash basis. If so, he can acquire 100 shares of stock at $ 100 each. Assume that the shares are disposed of a week later.

Case A

The market price of IBM at the time of disposal is $ 125. The 100 shares that Michael owns will therefore be worth $ 12,500. The rate of return is:

$$\frac{12{,}500 - 10{,}000}{10{,}000} = .25 \equiv 25\%$$

Case-B

The market price of IBM at the time of disposal is $ 80. Hence Michael's shares will be worth $ 8,000. The rate of return is:

$$\frac{8{,}000 - 10{,}000}{10{,}000} = -.20 \equiv -20\%$$

Now let us assume that instead of trading on a cash basis, Michael chooses to trade on margin at the outset. We will also assume that he borrows the maximum permissible amount, which is $ 10,000. With $ 20,000 in hand, he can acquire 200 shares of IBM. Now, the changes in the rates of return are given here.

Case-C

The price of IBM is $ 125 per share. The value of the shares is therefore $ 25,000. After returning $ 10,000 to the broker who funded the transaction, Michael will be left with $ 15,000. The rate of return is:

$$\frac{15{,}000 - 10{,}000}{10{,}000} = .50 \equiv 50\%$$

Case-B

At the time of disposal, the price of IBM is $ 80 per share. The shares are consequently worth $ 16,000. After returning the amount borrowed, the investor will be left with $ 6,000. The rate of return is:

$$\frac{6{,}000 - 10{,}000}{10{,}000} = -.40 \equiv -40\%$$

As can be seen, trading on the margin has doubled the rate of return. This is true, irrespective of whether the trade has led to a profit or to a loss.

Interest and Commissions

Example 3.2 was simplistic, because we ignored the interest due to the lender on the borrowed funds. When this is factored in, the result is a reduction in the percentage of profit in the event of a favourable price movement, and a further magnification of the percentage loss, if there is an adverse price change.

Margin interest income is a significant source of revenue for brokers/dealers. The standard borrowing arrangement is for the broker to obtain a margin or hypothecation agreement from the customer. In other words, the customer agrees to pledge or hypothecate the securities as collateral for the loan. The broker will then rehypothecate the securities to a bank, as collateral, in return for what is called a *call* or *broker loan*. The rate charged by the bank is called the *broker call money rate*, which is usually about 1% less than the *prime rate*, which is the rate at which a commercial bank lends to its best clients. For instance, in July 1999, the prime rate was 8% in the US, whereas the call money rate was 6.75%.[3] These loans can be terminated or called on demand by the lender, and hence the name. Since the loans are *collateralized* by readily marketable securities, they are considered to be fairly safe.

A broker will usually add a mark up to the call money rate before extending a loan to a client. The lowest rates ordinarily go to clients who have the largest debit balances. In other words, bigger borrowers pay less. Smaller

borrowers could pay up to as much as 2% more in practice. While the size of the loan is an obvious factor, so is the level of account activity. A customer with a smaller but considerably more active account may be able to negotiate a lower rate of interest, because the additional income generated by way of commissions will more than compensate the broker.

Example 3.3

Assume that the broker charges Michael an interest of 8% per annum on the amount borrowed. We will reexamine the consequences of a price increase and a price decline, assuming that the account is kept open for a period of three months.

Case-A

Assume that the terminal stock price is $ 125. The rate of return for Michael, who has bought 200 shares by borrowing $ 10,000 from the broker is:

$$\frac{25{,}000 - 10{,}000 - 200 - 10{,}000}{10{,}000} = .48 \equiv 48\%$$

Compared to Example 3.2, where it was assumed that no interest was payable, the rate of return has declined by 2%.

Case-B

If the terminal stock price is $ 80, after repaying the lender, the customer will be left with $ 5,800. The rate of return is:

$$\frac{5{,}800 - 10{,}000}{10{,}000} = -.42 \equiv -42\%$$

Thus, the negative rate of return has been magnified from –40% to –42%.

Thus, interest charges mitigate profits and magnify losses.

Example 3.4

Commissions, too, have an impact on the rate of return obtained by the investor. If the broker charges a 10 cents commission per share, the total charge for 100 shares will be $ 10. Assume that there is no interest payable.

Case-A

Assume that the terminal stock price is $ 125. Let us first consider a cash account. The investor would have paid $ 10 by way of commissions while acquiring 100 shares at the outset. He will similarly incur an expenditure of $ 10 while liquidating his position. So the initial outflow is $ 10,010 and the terminal inflow is $ 12,490. The rate of return would be:

$$\frac{12{,}490 - 10{,}010}{10{,}010} = .2478 \equiv 24.78\%$$

However, had he chosen to trade on the margin, he would have bought 200 shares by paying a commission of $ 20. So his initial investment would be $ 10,020. The cash inflow at the end would be $ 24,980. After repaying the broker he would be left with $ 14,980. The rate of return would be:

$$\frac{14{,}980 - 10{,}020}{10{,}020} = .4950 \equiv 49.50\%$$

Notice that here, the profit percentage is reduced because of commissions.

Case-B

Assume that the terminal stock price is $ 80. In the case of a cash account trade, the rate of return would be:

$$\frac{7{,}990 - 10{,}010}{10{,}010} = -.2018 \equiv -20.18\%$$

Had it been a margin trade, the rate of return would be:

$$\frac{5{,}980 - 10{,}020}{10{,}020} = -.4032 \equiv -40.32\%$$

Owner's Equity

The difference between the market value of the shares purchased on margin and the amount borrowed from the broker represents the owner's stake or equity.

Consider the case of Michael who purchased 200 shares of IBM at $ 100 per share by borrowing 50% of the required amount from the broker. In a T-Account format the position can be represented as:

Box No 3.1 Initial Equity Position	
Liabilities	*Assets*
Broker's Loan $ 10,000 Owner's Equity $ 10,000	200 Shares @ 100 $ 20,000

When the market price of the shares rises to $ 125, the position in the account can be represented as follows.

Box No 3.2 Equity Position after Price Rise	
Liabilities	*Assets*
Broker's Loan $ 10,000 Owner's Equity $ 15,000	200 Shares @ $ 125 $ 25,000

If the investor were to liquidate his position, he would receive a gross profit of $ 5,000 before taking into account interest charges and commissions. But what if he wishes to use the paper profits in his account, without liquidating his position? For instance, in the above case the owner's equity is $ 15,000. As per the 50% requirement, the equity required for an asset value of $ 25,000, is $ 12,500. Consequently there is an excess of $ 2,500. The investor may then withdraw some or all of this amount without selling any shares. If he were to withdraw the entire amount, his loan amount will increase by $ 2,500, and his equity will decline by $ 2,500. Consequently, the T-Account will look like:

Box No 3.3 Equity Position if Excess Equity is Withdrawn	
Liabilities	*Assets*
Broker's Loan $ 12,500 Owner's Equity $ 12,500	200 Shares @ $ 125 $ 25,000

Alternatively, the investor could use the excess to buy more shares of IBM, or any other marginable security. Since he is allowed to borrow up to 50% of the value of the purchase price, and because he currently has an

excess of $ 2,500, he can acquire shares worth $ 5,000. On doing so, his loan value, and the market value of the assets would both increase by $ 5,000. His equity will remain at $ 15,000. The T-Account will therefore be:

Box No 3.4

Equity Position if Additional Shares are Bought

Liabilities	*Assets*
Broker's Loan $ 15,000	240 Shares @ $ 125 $ 30,000
Owner's Equity $ 15,000	

However, stock prices do not always rise. What will be the consequence if the market were to decline? In practice, an undermargined account may eventually receive a notice for additional margin from the broker, failing which all or a part of the securities held in the account will be liquidated.

Maintenance Margin

The broker will usually insist that customers ought to demonstrate a minimum level of financial ability before being allowed to trade on margin. The intent of the rule is to discourage leveraged speculation by investors who are unable to appreciate or afford the attendant risks. In addition, the securities industry imposes a maintenance margin requirement to protect the brokers who extend credit to their customers. A maintenance margin is nothing but a threshold level of the shareholder's equity. If due to adverse price movements, the equity in the account were to hit or dip below this threshold, the cus-

tomer will get a margin call. The call is an instruction to replenish the equity to take the balance in the account to a safer level. If the investor fails to comply, he risks an involuntary closing out of the position. The objective of prescribing a maintenance margin level is obviously to protect the broker's investment.

Example 3.5

Steven buys 200 shares of IBM at $ 120 each, by borrowing $ 12,000. How low can the price of IBM fall, before it would trigger off a margin call, if the maintenance margin is 25%? Let us denote this price by P.

$$\frac{200P - 12{,}000}{200P} = .25$$

$$\Rightarrow \quad 200P = 50P + 12{,}000$$

$$\Rightarrow \quad P = \frac{12{,}000}{150} = 80$$

At this point, the T-Account would look as follows:

Box No 3.5

Equity Position Corresponding to Maintenance Margin Level

Liabilities	*Assets*
Broker's Loan $ 12,000	200 Shares @ $ 80 $ 16,000
Owner's Equity $ 4,000	

If the stock price were to go below $ 80, a call will be issued demanding an immediate deposit of new funds or securities to raise the equity to a level higher than 25%.

A margin call must be met on demand. Standard margin agreements allow a broker to sell stock from the account without notice. In periods of rapid market declines this could very well happen. In less extreme situations, brokers generally give customers one or two days to make the necessary deposits, but not much longer.

SHORT SELLING

When an investor expects the market to go through a bull phase or in other words expects stocks to rise in value, he will seek to acquire stocks in anticipation of being able to sell them subsequently at a higher price. The maxim is therefore, *buy low and sell high.*

Short sellers seek to do the opposite. That is, they attempt to *sell high and buy low.* The therefore, seek to profit from an anticipated bear phase, or a decline in the price of stocks.

Short selling requires investors to sell stocks that they do not own. How will an investor do this? The answer is simple. He will borrow the shares from the broker and sell them. The shares may come from the broker's own inventory, or from that of a customer who is long the security in his margin account. They can also be from an institutional investor, or from another brokerage firm.

A broker obtains the right to borrow securities from a client by appropriately wording the margin agreement. Such an agreement is known as a *customer loan consent.* A short sale order is not effective until the broker has received authorisation from his stock loan department, signifying that the security is available. The availability of a security can change from day to day. In practice,

short sale orders are accepted only as *day orders*. That is, they are valid only for the day on which they are placed. Hence, if such an order were to remain unexecuted at the end of a trading day, it would stand cancelled automatically. Customers who desire that such orders be kept alive, must therefore place them once again on the following day.

When a share is borrowed and sold, the proceeds will be credited to the investor's account. At some point, the shares will have to be purchased and returned to the broker. This is called *covering the short position*. If the price at this point of time is lower than the original purchase price, then the investor will make a gain. Else, he will have to take a loss.

Most of the time, a short position can be held open for as long as the investor desires. However, the lender may at times seek to call away the stock that he has lent. Then the broker can either borrow fresh shares on the investor's behalf, or request him to cover his position.

The investor or broker who parted with his shares to facilitate the sale by the short seller has not actually sold his shares. He has merely lent them. Consequently, he is entitled to any payouts made by the issuing corporation during the period of the short sale. In other words, he is entitled to any dividends declared in the interim. Similarly, if the stock were to undergo an n:1 split, he will be entitled to receive n shares when the position is closed, for each share that he lent at the outset. The only right that a lender of stock loses is his right to vote. This is because a short sale creates two long positions, the 'real' long position (which is held by the buyer of the stock from the short seller), and a 'phantom' long position (held by the person who has lent the stock).

Short selling is also a form of margin trading, because the investor is borrowing shares from the broker. Consequently, rules similar to buying a stock on margin will apply. In order to make it easier to track and monitor short sales and purchases, most brokerage firms execute and hold short sales in a *short account.* Such accounts are basically sub accounts of margin accounts.

An investor who is selling short must make the same deposit that would be required if the stock were to be purchased on margin. This deposit, plus the proceeds of the short sale, would show up as a credit balance in his account.

Example 3.6

Natalie decides to sell short 100 shares of IBM. The current price is $ 100 per share, and she is anticipating a decline in value. She will have to deposit 50% of the market value of the securities, or $ 5,000. Her account position may be represented as:

Box No 3.6

Initial Equity Position after the Short Sale

Liabilities	*Assets*
100 Shares @ $ 100 $ 10,000 Owner's Equity $ 5,000	Credit Balance $ 15,000

Now assume that the value of the shares drops to $ 80. The position will have an equity of $ 7,000. As per the

requirement, the necessary margin is $ 4,000. Thus there is an excess equity of $ 3,000. The excess can either be withdrawn or used for additional shorting. If the balance is withdrawn, the account position will be:

Box No 3.7

Equity Position if Excess Equity is Withdrawn

Liabilities	*Assets*
100 Shares @ $ 80 $ 8,000	Credit Balance $ 12,000
Owner's Equity $ 4,000	

Instead, the amount of $ 3,000 can be used to short additional shares worth $ 6,000. In this case, 75 more shares can be shorted. The position will then look like:

Box 3.8

Equity Position if Additional Shares are Shorted

Liabilities	*Assets*
175 Shares @ $ 80 $ 14,000	Credit Balance $ 21,000
Owner's Equity $ 7,000	

The credit balance in a short account provides collateral for the shares which have been sold short. They are not *free credit balances* in the sense that they cannot be removed from the account. So typically they will not earn any interest for the short seller. Any interest earned will accrue to the brokerage firm. Consequently, stock loan departments of brokerage firms are usually very profitable.

Maintenance of a Short Position

A short position is inherently more risky than a long position. When one buys a security on margin, the maximum possible loss is equal to the purchase price of the security. So if an investor acquires a stock on margin, the broker will tolerate losses until the maintenance margin level is reached. At this point, a margin call will be issued. If the investor fails to respond, the position will be liquidated and the funds due to the broker will be recovered. The remaining amount will be refunded to the investor. Thus, in practice, an investor's loss would be somewhat less than the full purchase price of the stock.

In the case of a short sale, however, stock and not cash has been loaned. Unlike a maximum downside potential, due to the limited liability feature of corporate entities, there is no limit on how high the asset price can rise. The short seller is required to acquire the stock at the prevailing market value at the time of covering the short sale. Therefore, the maximum possible loss, in principle, is infinite.

Thus the maintenance margin on short positions is set at higher levels to reflect the greater risk involved.

Example 3.7

Assume that Natalie has sold 100 shares of IBM at $ 130, and has deposited an initial margin of $ 6,500. Let the price corresponding to a 30% margin level be denoted by *P*. Therefore:

$$\frac{19{,}500 - 100P}{100P} = .30$$

$$\Rightarrow \quad 15{,}000 - 100P = 30\,P$$

$$\Rightarrow \quad P = \frac{1950}{13} = 150.00$$

Shorting Against-the-Box

This entails the establishment of a short position in a security that a client already has a long position in, where the investor has no intention of delivering the stock that he is holding. In other words, in such a strategy, despite the fact that he holds a long position in the security, the investor will borrow the security to deliver.

Typically traders go in for such a strategy to defer any unrealised capital gains for tax purposes, while at the same continuing to protect the magnitude of the capital gain.

Example 3.8

Assume that we are in 15 December 20XX. Assume that we had purchased a stock in March of that year for $ 1,000 and that the stock is currently worth $ 1,500. An immediate sale would realise a profit of $ 500, which would entail a tax payment of $ 100 assuming a tax rate of 20%. However a client may like to defer the sale by a year since he is anticipating a loss from elsewhere which can be set off against this capital gain. Of course if he were to wait for a year, the risk is that the share price may decline, leading to a reduced capital gain or even to a capital loss. In such a situation, the client can defer the capital gain while continuing to protect its quantum by engaging in a short sale.

If he were to engage in a short sale, any change in the value of the existing long position would be exactly offset by an equal and opposite change in the value of the newly established short position. Consequently the net result would be a freeze on the capital gain of $ 500. For instance, if the share price were to rise to $ 1,800 after six months, the capital gain on the long position would be $ 800. However, the short position would lead to a loss of $ 300. The net result would be an overall capital gain of $ 500.

When an investor does a short sale against-the-box he must post the usual margin. Besides, the transaction must be approved as usual by the broker's stock loan department. In other words, just because a customer is long in a security does not mean that he automatically has the freedom to short.

The Risk Factor

In general, over a medium to long-term horizon, stock prices have a tendency to drift upwards. This is because, even if the performance of the company were to remain stagnant, its share price should rise over a period of time to compensate owners for the effects of inflation. Thus, short selling tantamounts to betting against the overall direction of the market.

Short sales entail finite profits and infinite losses. This is because, while the theoretical minimum stock price is zero, there is no theoretical maximum. Consequently, while profits are capped at 100%, potential losses cannot be capped.

If a stock starts to rise and a large number of short sellers try to cover their positions at the same time, it can quick-

ly send prices spiraling upwards. This phenomenon is known as a *short squeeze*. Usually, news in the market will trigger a short squeeze. But, at times, a trader who notices a high short interest, will attempt to induce a squeeze. A short seller could lose a lot of money very fast under such circumstances.

Economic Role of Short Sales

Many market analysts have held short sales as a major cause of market downturns. However, short selling contributes positively to the functioning of a free market system. It provides liquidity and drives the prices of overvalued securities down to realistic levels.

Exercises

1. Greg Norman buys 500 shares of IBM shares which are currently priced at $ 80 each by putting up 50% of the required amount from his own funds. He keeps the position open for six months. The broker charges interest at the rate of 6% per annum on the loan amount. A commission of 20 cents per share is payable both at the time of purchase and at the time of sale.
   (a) If the price of a share after six months is $ 100, what is Greg's profit in percentage terms?
   (b) If the price of a share after six months is $ 60, what is Greg's profit in percentage terms?
   (c) If the broker fixes a maintenance margin level of 30%, how low can the share price go before Greg receives a margin call?

2. Nancy Tellis has bought 1,000 shares of IBM which are currently priced at $ 100 each, by putting up 50% of the required amount from her own funds.
   (a) Depict the initial position in a T-account format.
   (b) Assume that the share price rises to $ 120. Show the new position in a T-account format.
   (c) Assume that the share price falls to $ 80. Show the new position in a T-account format.
   (d) If the share price rises to $ 120 what is Nancy's excess equity? What is the buying power of this excess?
   (e) Assume that the share price rises to $ 120, and that Nancy withdraws the excess equity. Show the new position in a T-account format.
   (f) Assume that the share price rises to $ 120, and that Nancy decides to acquire additional shares on the margin. Show the new position in a T-account format.
3. David Ellis has short sold 1,000 shares of General Electric which is currently priced at $ 40. He has deposited 50% of the initial value of the shares as collateral.
   (a) Show the initial position in a T-account format.
   (b) Assume that the share price rises to $ 50. Show the new position in a T-account format.
   (c) Assume that the share price falls to $ 25. Show the new position in a T-account format.
   (d) If the share price falls to $ 25, what is David's excess equity?

(e) Assume that the share price falls to $ 25, and that David withdraws the excess equity. Show the new position in a T-account format.

(f) Assume that the share price falls to $ 25, and that David decides to short additional shares. What is David's shorting power? Show the new position in a T-account format.

ENDNOTES

1. The concepts of margin trading and short selling are relatively new to the Indian market and the mechanics are still evolving. In this chapter, we focus on the general principles as applicable to the US market.
2. Because of the 50% margin requirement, he can borrow an amount up to the funds at his disposal.
3. See Reilly and Brown (2000).

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4

CHAPTER

Stock Market Indices

INTRODUCTION

A STOCK INDEX IS A SUMMARY measure of the market's performance based on the prices (or the market capitalization) of a pre-defined set of stocks. The index value serves as a barometer of stock market performance or of a particular segment of the stock market. Consequently, the stocks constituting the index ought to be chosen so as to be representative of the market or the market segment, as the case may be.

PRICE WEIGHTED INDICES

A price weighted index is computed by considering only the prices of the component stocks. At the time of computation of the index, the current prices of all the component stocks will be added up and divided by a number known as the *divisor*. On the base date, (the date on which the index is being computed for the first time) the divisor can be set equal to any arbitrary value. One sensible

value is the number of stocks which constitute the index. Subsequently, whenever there is a relevant corporate action such a split/reverse split or stock dividend, the divisor will be suitably adjusted (discussed later).

So if we are standing at the end of day t, and the closing price of the ith stock on the day is $P_{i,t}$, then the index level I_t, is given by

$$I_t = \sum_{i=1}^{N} \frac{P_{i,t}}{Div_t}$$

where Div_t is the applicable value of the divisor for the day, and N is the number of stocks comprising the index.

Example 4.1

Assume that we are standing on the base date of an index, which has been defined to comprise of five stocks. The starting value of the divisor has been chosen as 5.0. Let the closing prices of these five stocks at the end of the day be as shown:

Table 4.1

Prices of the Constituent Stocks on the Base Date

Stock	*Price*
ACC	907
Bombay Dyeing	81
Colgate Palmolive	211
Escorts	68
Hindustan Lever	732
Total	1999

The end of the day index value will therefore be

$$\frac{1999}{5} = 399.80.$$

Let us suppose that at the end of the following day, the prices of the stocks are as follows:

Table 4.2

Prices of the Constituent Stocks on the Following Day

Stock	*Price*
ACC	925
Bombay Dyeing	90
Colgate Palmolive	225
Escorts	75
Hindustan Lever	750
Total	2065

The value of the index on this day will be

$$\frac{2065}{5} = 413$$

We will then conclude that the market has moved up. In this case, it would be the correct deduction for, comparing Tables 4.1 and 4.2, every stock has risen in value.

Changing the Divisor

The divisor has to be adjusted if one or more of the following events occur:

- A split or a reverse split in one of the constituent stocks

- A stock dividend on one of the constituent stocks
- A change of composition, that is, a replacement of existing stock(s) by new stock(s)

We will illustrate the mechanics of adjustment by considering a scenario where one of the constituent stocks undergoes a split.

Example 4.2

Assume that ACC undergoes a 3:1 split at the end of the base date. Let the prices of the constituent stocks at the end of the following day be as follows:

Table 4.3
Prices of the Constituent Stocks on the Following Day, Assuming a Stock Split in ACC

Stock	*Price*
ACC	308
Bombay Dyeing	90
Colgate Palmolive	225
Escorts	75
Hindustan Lever	750
Total	1448

When we compare Table 4.3 with the previous one, we find that all the other stocks have the same value as before, except for ACC. Its value is approximately one-third of the value it would have had in the absence of the split.

If we were to use a divisor of 5.0 under these circumstances, we will get an index value of

$$\frac{1448}{5} = 289.6.$$

The conclusion would then be that the market has crashed as compared to the base date. This is clearly an erroneous deduction, for every stock (including ACC) has risen in value as compared to the base date. The perceived decline in the index is entirely due to our failure to take the split into account.

If the index has to continue to be an accurate barometer of the market, then clearly an adjustment needs to be made. In practice, to adjust the divisor, we would first list the theoretical post-split values at the end of the day on which the split was declared. The split will affect only the price of the stock whose shares have been split. In this case, the theoretical post-split price of ACC will be one-third of its pre-split value of Rs. 907.

Table 4.4

Theoretical Post-Split Stock Prices

Stock	*Price*
ACC	302.33
Bombay Dyeing	81
Colgate Palmolive	211
Escorts	68
Hindustan Lever	732
Total	1394.33

The new divisor, Div_N, should be such that the pre- and post-split index values for the base date are the same when the post-split index level is computed using it. That is, $\frac{1394.33}{Div_N}$ should equal 399.80. The new divisor is therefore 3.4876. If we use this value of the divisor to compute the index level on the following day, we will get a value of

$$\frac{1448}{3.4876} = 415.1852$$

This is consistent with our earlier observation that the market has risen.

We will continue to use the new divisor until another stock undergoes a split or a reverse split, or if a firm declares a stock dividend. The adjustment procedure for a stock dividend is identical to that for a stock split since the two are mathematically equivalent. So if a firm were to declare a stock dividend of 40%, it would be equivalent to a 7:5 split, and would be treated as such.

Now we will illustrate the adjustment procedure in the event of a change in composition.

Example 4.3

Let us assume that at the end of the day after the base date, Escorts whose prevailing market price is Rs. 75 is replaced with Ranbaxy, which has a price of Rs. 120. The index level prior to the change is 415.1852. The prices of the stocks contained in the reconstituted index will be as shown in Table 4.5.

Table 4.5
Prices of the Component Stocks of the Reconstituted Index

Stock	*Price*
ACC	308
Bombay Dyeing	90
Colgate Palmolive	225
Ranbaxy	120
Hindustan Lever	750
Total	1493

The new divisor, Div_N, should be such that

$$\frac{1493}{Div_N} = 415.1852$$

$$\Rightarrow \quad Div_N = 3.5960$$

Importance of Price

Higher priced stocks tend to have a greater impact on price weighted indices than lower priced components of the same index.

Example 4.4

Let us take the following data for our five stock index on a particular day. Assume that the divisor is 5.0.

Table 4.6
Prices of the Constituent Stocks on a Given Day

Stock	*Price*
ACC	900
Bombay Dyeing	90
Colgate Palmolive	200
Escorts	80
Hindustan Lever	700
Total	1970

The index level is $\frac{1970}{5} = 394$.

Consider two possible situations for the following day. In case A, ACC's price has gone up by 20%, whereas in Case B, Colgate's price has gone up by 20%.

Table 4.7
Prices on the Following Day: Two Different Scenarios

Stock	*Case A Price*	*Case B Price*
ACC	1080	900
Bombay Dyeing	90	90
Colgate Palmolive	200	240
Escorts	80	80
Hindustan Lever	700	700
Total	2150	2010

In the first case, the index value is 430. This represents an increase of 9.14% as compared to the previous day. In the second case the index value is 402, which represents an increase of only 2.03%. Clearly, a change of 20% in the price of ACC, which is a high priced stock, has had a greater impact than a similar change in the price of Colgate, which is priced considerably lower.

Finance theorists hold the view that the importance accorded to a company ought to be based on its market capitalisation and not its share price. Market capitalisation is defined here as the share price multiplied by the total number of shares outstanding. A model like the Capital Asset Pricing Model is consistent with this viewpoint, for it defines the *market portfolio* as a market capitalisation weighted portfolio of all assets. Thus, a price weighted index can in a sense be construed as a less than perfect barometer of the stock market.

VALUE WEIGHTED INDICES

A value weighted index takes into consideration the market capitalisation of a component stock and not merely its price.

Let us assume that we are standing on day t, and let us denote the starting or base date of the index by b. We will use $P_{i,t}$ and $P_{i,b}$ to denote the market prices of the i th stock on days t and b respectively, and $Q_{i,t}$ and $Q_{i,b}$ to denote the number of shares outstanding on those two days.

On the base date, the index can be assigned any value. Let us assume that it was set equal to 100. The level of the index on day t is then defined as

$$\frac{1}{Div_t}\left(\frac{\sum_{i=1}^{N} P_{i,t}\, Q_{i,t}}{\sum_{i=1}^{M} P_{i,b}\, Q_{i,b}}\right) \times 100$$

Div_t represents the value of the divisor on day t. The divisor is assigned a value of 1.0 on the base date. It can be adjusted as and when required. However, the circumstances under which it needs to be adjusted are different from the ones used for the divisor in a price weighted index. Also note that we have used M to denote the number of component stocks on the base date and N to denote the number of component stocks on day t. In practice, M need not equal N. That is, an index may subsequently be modified to include more or less number of stocks than it had on the base date.

Example 4.5

We will take the same five stocks as before and use the prices shown in Table 4.8. The difference is that we will now also consider the number of shares issued by each firm.

The total market value is

$$\sum_{i=1}^{5} P_i Q_i = 2{,}206{,}800{,}000$$

Let us assign the index a value of 100. The corresponding value for the divisor is obviously 1.0.

Table 4.8

Prices, Number of Shares Outstanding and Market Capitalisation of the Components of a Value Weighted Index on the Base Date

Stock	*Price (P)*	*# of Shares (Q)*	*Market Capitalisation*
ACC	907	1,000,000	907,000,000
Bombay Dyeing	81	500,000	40,500,000
Colgate Palmolive	211	700,000	147,700,000
Escorts	68	200,000	13,600,000
Hindustan Lever	732	1,500,000	1,098,000,000

Now suppose that on the following day, the prices and number of shares are as depicted here:

Table 4.9

Prices, Number of Shares Outstanding and Market Capitalisation of the Components of a Value Weighted Index on the Following Day

Stock	*Price (P)*	*# of Shares (Q)*	*Market Capitalisation*
ACC	925	1,000,000	925,000,000
Bombay Dyeing	90	500,000	45,000,000
Colgate Palmolive	225	700,000	157,500,000
Escorts	75	200,000	15,000,000
Hindustan Lever	750	1,500,000	1,125,000,000

The total market value is

$$\sum_{i=1}^{5} P_i Q_i = 2{,}267{,}500{,}000$$

The value of the index on this day is therefore

$$\frac{2{,}267{,}500{,}000}{2{,}206{,}800{,}000} \times 100 = 102.7506$$

Our conclusion would therefore be that the market has moved up.

Changing the Divisor

There is no need to adjust the divisor if one of the components of the index were to undergo a split or a reverse split or if a firm that is present in the index were to declare a stock dividend. This is because, from a theoretical standpoint, such corporate actions will not have any impact on the market capitalisation of the firm.

In the case of a stock split or a stock dividend the share price will decline, whereas in the case of reverse split the share price will rise. However, in the first two cases the number of shares outstanding will rise whereas in the last case it will decline. The changes in the number of shares outstanding will always be such that there is no impact on the market capitalisation.

Example 4.6

Assume that Hindustan Lever has a market price of Rs. 750, and that the number of shares outstanding is 1,500,000. Assume that the firm announces a 20% stock dividend. The share price will immediately decline to

$$\frac{750 \times 1{,}500{,}000}{1{,}800{,}000} = \text{Rs. } 625.$$

As can be seen, the market capitalisation before the stock dividend,

$$750 \times 1{,}500{,}000 = 1{,}125{,}000{,}000$$

is the same as the market capitalisation after the dividend, which is

$$625 \times 1{,}800{,}000 = 1{,}125{,}000{,}000$$

The divisor would however have to be changed whenever there is a change in the composition of the index. Let us assume that the prices and number of shares of the companies constituting the index are as shown in Table 4.9, at the end of day *t*. Assume that Escorts with a price of Rs. 75 and number of shares outstanding equal to 200,000, is replaced with Ranbaxy which has a price of Rs. 120 and number of shares outstanding equal to 100,000. The market capitalisation of the component stocks after the change will be as depicted:

Table 4.10

Market Capitalisation of the Component Stocks of the Reconstituted Index

Stock	*Price (P)*	*# of Shares (Q)*	*Market Capitalisation*
ACC	925	1,000,000	925,000,000
Bombay Dyeing	90	500,000	45,000,000
Colgate Palmolive	225	700,000	157,500,000
Ranbaxy	120	100,000	12,000,000
Hindustan Lever	750	1,500,000	1,125,000,000

The total market capitalisation after the change is 2,264,500,000. The new divisor, Div_N, should be such that

$$\frac{1}{Div_N} \times \frac{2{,}264{,}500{,}000}{2{,}206{,}800{,}000} \times 100 = 102.7506$$

$$\Rightarrow \quad Div_N = 0.9987$$

Changing the Base Period Capitalisation

One of the ways of handling a change in the composition of a value weighted index is by changing the divisor. This is the approach taken in the US for a value weighted index such as the Standard & Poor's 500 index. In such cases, the market capitalisation of the component stocks on the base date will always stay frozen at its initial level. Subsequent changes in composition will be handled by adjusting the divisor as demonstrated earlier.

In India, a different but equivalent approach is adopted in the case of value weighted indices such as the Sensex and the Nifty. In the case of a change in the composition of these indices, the divisor is always maintained at the initial value of 1.0. The market capitalisation on the base date is however changed to reflect the change in the composition of the index.

Let us take the data depicted in Table 4.10. If we denote the modified base period capitalisation by BPC_N, then it should be such that

$$\frac{2{,}264{,}500{,}000}{BPC_N} \times 100 = 102.7506$$

$$\Rightarrow \quad BPC_N = 2{,}203{,}880{,}075$$

For all subsequent calculations, the new value will be used for the base period capitalisation, until there is another change in the composition of the index.

EQUALLY WEIGHTED INDICES

An equally weighted index is yet another alternative for tracking the performance of a market. Let us assume that we decide to form an index consisting of N stocks. In this case, like in the case of a price weighted index, only the prices of the component stocks are considered.

The value of the index on day t is defined as

$$I_t = I_{t-1} \times \frac{1}{N} \sum_{i=1}^{N} \frac{P_{i,t}}{P_{i,t-1}}$$

The ratio of the prices, $\frac{P_{i,t}}{P_{i,t-1}}$ may be expressed as $(1 + r_{i,t})$ where $r_{i,t}$ is the arithmetic rate of return on the ith stock between day t and day $t - 1$. Therefore

$$\frac{1}{N} \sum_{i=1}^{N} \frac{P_{i,t}}{P_{i,t-1}} = \frac{1}{N} \sum_{i=1}^{N} (1 + r_{i,t})$$

$$= 1 + \frac{1}{N} \sum_{i=1}^{N} r_{i,t} = 1 + \bar{r}_t$$

where $\bar{r}_t$ is the arithmetic average of the returns on all the component stocks between day $t - 1$ and day t. Thus

$$I_t = I_{t-1} \times (1 + \bar{r}_t)$$

TRACKING PORTFOLIOS

It is possible to hold a portfolio that imitates the behaviour of a market index. The method of forming such a

portfolio would depend on the nature of the index that is being tracked.

To imitate an equally weighted index, one has to put an equal fraction of his wealth in all the assets that constitute the index. So if we start with a capital of Rs W, and the index consists of N stocks, then we will have to invest an amount of $\frac{W}{N}$ in each security.

In order to track a price weighted index, one has to hold an identical number of shares of each of the companies that are present in the index.

Finally, forming a portfolio to track a value weighted index is the most complex task. To imitate such an index, the fraction of our wealth that is invested in each asset should be equal to the ratio of the market capitalisation of that particular asset to the total market capitalisation of all the assets that constitute the index.

Rebalancing a Tracking Portfolio

In the case of every index, be it equally weighted, price weighted, or value weighted, there will arise circumstances when the tracking portfolio will have to be rebalanced.

Equally weighted portfolios

Equally weighted tracking portfolios need to be rebalanced very frequently. Unless none of the component stocks undergoes a change in price from one day to the next, an index that is equally weighted on a particular

day will no longer be so on the following day. We will now illustrate as to why an equally weighted portfolio will require rebalancing with the sheer passage of time.

Example 4.7

Assume that we have Rs. 500,000 and decide to form an equally weighted portfolio consisting of the following four stocks.

Table 4.11

Prices of the Stocks Constituting an Equally Weighted Index at the Time of Formation of the Portfolio

Stock	*Price*
Alfa Laval	50
Atlas Copco	100
Sandvik	40
Sulzer	125

Since we have Rs. 500,000, we will have to invest Rs. 125,000 in each stock. So we will buy 2,500 shares of Alfa Laval, 1,250 shares of Atlas Copco, 3,125 shares of Sandvik, and 1,000 shares of Sulzer. If we assume that the index value is 100, our portfolio is worth 5000 times the index.

On the next day, assume that the prices of the companies are as follows.

Table 4.12

Prices of the Stocks Constituting an Equally Weighted Index on the Following Day

Stock	*Price*
Alfa Laval	40
Atlas Copco	125
Sandvik	50
Sulzer	100

The amounts invested in the stocks will be Rs. 100,000, Rs. 156,250, Rs. 156,250, and Rs. 100,000 respectively. The total portfolio value will be Rs. 512,500, of which 19.51% each will be in Alfa Laval and Sulzer, and 30.49% each will be in Atlas Copco and Sandvik.

Quite obviously, the portfolio is no longer equally weighted. If we have to reset the weights to 0.25 each, then we will have to rebalance by selling part of our holdings in Atlas Copco and Sandvik, and investing the proceeds in Alfa Laval and Sulzer.

The total value of the portfolio is Rs. 512,500. This means that we need to have Rs. 128,125 in each stock for it to be equally weighted. For this, we would need to buy 703.125 shares of Alfa Laval, and 281.25 shares of Sulzer. We would need to sell 225 shares of Atlas Copco, and 562.50 shares of Sandvik.

The inflow is $225 \times 125 + 562.50 \times 50 =$ Rs. 56,250

The outflow is $703.125 \times 40 + 281.25 \times 100 =$ Rs. 56,250

Thus we can rebalance at zero net cost. It can be verified that the amount invested in each company is Rs. 128,125.

The new index level is $100 \times (1 + \bar{r}_t)$.

$$\bar{r}_t = \frac{(-0.20 + 0.25 + 0.25 - 0.20)}{4} = \frac{0.10}{4} = 0.025$$

Therefore the new value of the index is 102.50. The total value of the portfolio is Rs. 512,500 which is 5000 times the value of the index. Hence the portfolio continues to mimic the index.

Price weighted portfolios

A portfolio that is used to track a price weighted index, has to be rebalanced whenever there is a split or a reverse split, a stock dividend, or a change in the index composition.

Example 4.8

Consider a price weighted index consisting of the four stocks depicted in Table 4.11. Assume that the divisor is equal to 4.0. This would mean that the index level is

$$\frac{50 + 100 + 40 + 125}{4.0} = 78.75$$

Assume that we form a tracking portfolio by buying 1000 shares of each of these companies. The value of our tracking portfolio will be

$$1000 \times (50 + 100 + 40 + 125) = \text{Rs. } 315{,}000$$
$$= 4{,}000 \times 78.75$$

Thus our portfolio is worth 4000 times the index.

Now assume that Atlas Copco undergoes a 2:1 split, which means that its post-split theoretical value will be Rs. 50. The new divisor, Div_N, should be such that

$$\frac{50 + 50 + 40 + 125}{Div_N} = 78.75$$

$$\Rightarrow \quad Div_N = 3.3651$$

In order to ensure that our portfolio continues to mimic the index, we need to rebalance in such a way that our portfolio value remains unchanged. Let us denote the number of shares of each stock held before the split by N_o, and the number of shares required after the split by N_N. If the value of our portfolio is to remain unchanged, it should be that:

$$N_0 \times Div_o \times I_t = N_N \times Div_N \times I_t$$

$$\Rightarrow \quad N_N = \frac{N_0 \times Div_o}{Div_N}$$

Hence, the number of shares of each stock required after the split is

$$\frac{1000 \times 4.0}{3.3651} = 1{,}188.672$$

Assuming that fractional shares can be bought and sold, we will have to buy 188.672 shares of Alfa Laval, Sandvik, and Sulzer, and sell 811.328 shares of Atlas Copco.[1]

The inflow is $811.328 \times 50 =$ Rs. 40,566.40

The outflow is $188.672 \times (50 + 40 + 125) =$ Rs. 40,564.48

Once again, if we ignore transactions costs, we can rebalance at zero net cost. The difference between the inflow and the outflow is entirely due to rounding errors.

Value weighted portfolios

Example 4.9

Assume that there is a value weighted index consisting of four stocks, whose prices and number of shares outstanding are as follows.

Table 4.13

Components of a Value Weighted Index

Stock	*Price (P)*	*# of Shares (Q)*	*Market Capitalisation*
MRF	20	100,000	2,000,000
J.K. Tyres	40	50,000	2,000,000
Apollo Tyres	50	100,000	5,000,000
Vikrant Tyres	10	100,000	1,000,000

The total market capitalisation is Rs. 10,000,000. Assume that the base period market capitalisation is Rs. 16,000,000 and that the current divisor is 1. The index level is therefore 62.50.

Take the case of a person with a capital of Rs. 200,000, who wants to create a portfolio to track the index. In order for his portfolio to mimic the index, he must have

$$\frac{2{,}000{,}000}{10{,}000{,}000} \times 200{,}000 = \text{Rs. } 40{,}000 \text{ in MRF stock}$$

$$\frac{2{,}000{,}000}{10{,}000{,}000} \times 200{,}000 = \text{Rs. } 40{,}000 \text{ in J.K. Tyres stock}$$

$$\frac{5{,}000{,}000}{10{,}000{,}000} \times 200{,}000 = \text{Rs. } 100{,}000 \text{ in Apollo Tyres stock}$$

$$\frac{1{,}000{,}000}{10{,}000{,}000} \times 200{,}000 = \text{Rs. } 20{,}000 \text{ in Vikrant Tyres stock}$$

Consequently, he must buy 2000 shares of MRF, 1000 shares of J.K. Tyres, 2000 shares of Apollo Tyres and 2000 shares of Vikrant Tyres. In general, the number of shares of the ith stock is given by

$$\frac{Q_i}{\sum P_i Q_i} \times W$$

where W is the initial wealth. The total portfolio value in this case is 3200 times the index value of 62.50.

Now assume that Vikrant Tyres is replaced by Ceat, which has a share price of Rs. 35 and has 100,000 shares outstanding. The total market capitalisation of the four components of the index will now be Rs. 12,500,000. The divisor will have to be adjusted in such a way that the index level remains unchanged. That is

$$\frac{1}{Div_N} \times \frac{12{,}500{,}000}{16{,}000{,}000} \times 100 = 62.50$$

$$\Rightarrow \quad Div_N = 1.25$$

In order for the portfolio to remain value weighted, the investor must have

$$\frac{2{,}000{,}000}{12{,}500{,}000} \times 200{,}000 = \text{Rs. } 32{,}000 \text{ in MRF stock}$$

$$\frac{2{,}000{,}000}{12{,}500{,}000} \times 200{,}000 = \text{Rs. } 32{,}000 \text{ in J.K. Tyres stock}$$

$$\frac{5{,}000{,}000}{12{,}500{,}000} \times 200{,}000 = \text{Rs. } 80{,}000 \text{ in Apollo Tyres stock}$$

$$\frac{3,500,000}{12,500,000} \times 200,000 = \text{Rs. } 56,000 \text{ in Ceat stock}$$

Thus, the investor requires 1600 shares of MRF, 800 shares of J.K., 1600 shares of Apollo and 1600 shares of Ceat. This means that he will have to sell 400 shares of MRF, 200 shares of J.K, 400 shares of Apollo and 2000 shares of Vikrant. He will also have to buy 1600 shares of Ceat.[2]

$$\begin{aligned}\text{The inflow} &= 400 \times 20 + 200 \times 40 + 400 \times 50 \\ &\quad + 2000 \times 10 \\ &= \text{Rs. } 56,000.\end{aligned}$$

$$\text{The outflow} = 1600 \times 35 = \text{Rs. } 56,000.$$

Thus, if we ignore transactions costs, then once again we can rebalance at zero net cost. The portfolio value after rebalancing will be Rs. 200,000, which is 3200 times the index level of 62.50.

THE FREE FLOATING METHODOLOGY

The standard definition of a value weighted index is based on the market capitalisation of the constituent stocks, where the market capitalisation is defined as the price of the share multiplied by the total number of shares issued by the company. The free floating methodology however computes the market capitalisation of a stock as the share price multiplied by the number of shares that are freely available for trading in the market. As per the Mumbai stock exchange, the following categories of shares are generally excluded while computing the freely tradeable shares:

1. Holdings by founders/Directors/acquirers which have a control element
2. Holdings by persons/bodies with controlling interest
3. Government holding as promoter/acquirer
4. Holdings through the FDI route
5. Strategic stakes by private corporate bodies/individuals
6. Equity held by associate/group companies (cross-holdings)
7. Equity held by Employee Welfare Trusts
8. Locked-in shares which would not be sold in the open market in normal course

Under the free floating methodology, the market capitalisation of widely held companies will be high, while that of closely held companies will stand reduced. One of the arguments advanced against the full market capitalisation based indices is that those index constituents which have a relatively smaller percentage of shares available for trading are vulnerable to sharp price fluctuations. Thus, not only will a price move in such an illiquid stock cause the index to move sharply, such stocks are also vulnerable to manipulation by speculators. Consequently, by defining the index on the basis of free floating shares, we can ensure that it reflects the underlying market movement in a better way.

In the case of the Sensex, companies whose free floating shares fall in a certain range (called a band) are given equal weightage. Such banding is adopted for two reasons. First, the calculation of the exact free float for a company is difficult. Second, using exact free float factors may require frequent changes in the weights of the

constituent stocks. This could therefore give rise to a need for portfolio managers to realign their portfolios frequently.

The BSE adopts the following system for determining the free float factor for a stock. The market capitalisation for the purpose of computing the index is defined as the share price times the number of shares issued by a company times the free float factor. Once the free float percentage for a company is determined it is rounded off to the higher multiple of five, and the weightage is determined as per the banding system given in Table 4.14.

Table 4.14

Banding System Adopted by the BSE

% Free Float	*Factor*	*% Free Float*	*Factor*
> 0 – 5%	0.05	> 50 – 55%	0.55
> 5 – 10%	0.10	> 55 – 60%	0.60
> 10 – 15%	0.15	> 60 – 65%	0.65
> 15 – 20%	0.20	> 65 – 70%	0.70
> 20 – 25%	0.25	> 70 – 75%	0.75
> 25 – 30%	0.30	> 75 – 80%	0.80
> 30 – 35%	0.35	> 80 – 85%	0.85
> 35 – 40%	0.40	> 85 – 90%	0.90
> 40 – 45%	0.45	> 90 – 95%	0.95
> 45 – 50%	0.50	> 95 – 100%	1.00

Well Known Global Indices

The most famous index is undoubtedly the Dow Jones Industrial Average (DJIA), popularly known as the Dow. It is a price weighted average of 30 stocks. The list of constituent stocks is as follows:

Table 4.15

Constituents of the Dow Jones Industrial Average as on June 9, 2006

3M	Alcoa	Altria Group
American Express	American International Group	AT&T
Boeing	Caterpillar	Citigroup
Coca Cola	E.I. DuPont de Nemours	Exxon Mobil
General Electric	General Motors	Hewlett-Packard
Home Depot	Honeywell International	Intel
IBM	Johnson & Johnson	J.P. Morgan Chase
McDonald's	Merck	Microsoft
Pfizer	Procter & Gamble	United Technologies
Verizon Communications	Wal-Mart Stores	Walt Disney

The Nikkei Index, which is a barometer of the Japanese stock market, is also price weighted and includes 225 large Japanese companies.

The Nifty and the Sensex are both value weighted indices. The Nifty consists of 50 stocks while the Sensex consist of 30. In the US, the Standard & Poor's 500 Index (S&P500) and the Nasdaq 100 index are both value weighted.

Table 4.16

Constituents of the Nifty as on June 9, 2006

ABB	ACC	Bajaj Auto
BHEL	Bharti Televentures	BPCL
Cipla	Dabur	Dr. Reddy's Lab.
GAIL	Glaxo Smithkline Pharma	Grasim
Gujarat Ambuja	HDFC Bank	HCL Technologies
Hero Honda Motors	HINDALCO	Hindustan Lever
HPCL	HDFC	ITC
ICICI Bank	IPCL	Infosys Technologies
Jet Airways	L& T	MTNL

(*Contd.*)

(Contd.) Table 4.16

Mahindra & Mahindra	Maruti Udyog	NALCO
ONGC	Oriental Bank of Commerce	Punjab National Bank
Ranbaxy Lab.	Reliance Energy	Reliance Industries
Satyam Computer Services	Shipping Corp.	SBI
SAIL	SUN Pharma	Tata Chemicals
Tata Motors	TCS	Tata Steel
Tata Power	Tata Tea	VSNL
WIPRO	Zee Telefilms	

Table 4.17

Constituents of the Sensex as on June 9, 2006

ACC	Bajaj Auto	Bharti Televentures
BHEL	Cipla	Dr. Reddy's Lab.
Grasim	Gujarat Ambuja Cements	HDFC

(*Contd.*)

(Contd.) Table 4.17

HDFC Bank	Hero Honda Motors	HINDALCO
Hindustan Lever	ITC	ICICI Bank
Infosys Technologies	L&T	Maruti Udyog
NTPC	ONGC	Ranbaxy Lab.
Reliance Energy	Reliance Industries	Satyam Computers
SBI	Tata Motors	Tata Power
Tata Steel	TCS	WIPRO

Exercises

1. Consider the following data.

Company	*Price*	*# of Shares Outstanding*
Helium	$ 50	1,000,000
Neon	$ 75	1,500,000
Argon	$ 25	500,000
Krypton	$ 100	2,000,000

(a) Consider a price weighted index that is based on these four stocks. If the divisor is 2.50, what will be the index value?

(b) Consider a value weighted index based on these four stocks. If the divisor is 0.975, the base period market capitalisation is $ 325,000,000, and the base period index level is 100, what will be the value of the index?

(c) Assume that Neon undergoes a 3:1 split. If the pre-split divisor is 2.50, what will be the post-split divisor, assuming that the index is price weighted?

(d) Assume that Krypton is replaced by Radium which has a price of $ 200 and number of shares outstanding equal to 4,500,000. If the divisor prior to the change is 0.975, the base period market capitalisation is $ 325,000,000, and the base period index level is 100, what will be the divisor after the change in composition of the index, assuming that the index is value weighted?

2. Consider the following data.

Company	*Price*
Thorium	$ 100
Radium	$ 200
Titanium	$ 200
Xeon	$ 500

Assume that an investor forms a mimicking portfolio by buying 2,000 shares of each stock. The divisor of the corresponding price weighted index is 2.50. If Xeon undergoes a 1:2 reverse split, show that the mimicking portfolio can be rebalanced at zero net cost.

3. Consider the following data.

Company	*Price*	*# of Shares Outstanding*
Everest	Rs. 100	1,000,000
Kailash	Rs. 200	1,000,000
Taragarh	Rs. 200	1,000,000
Sagar	Rs. 500	1,000,000

The divisor is 0.925 and the base period market capitalisation is 725,000,000. The index value on the base date was 100. Assume that Everest is replaced by Elbruz with a price of Rs. 550, and number of shares issued equal to two million.

Take the case of an investor who has formed a value weighted tracking portfolio by investing Rs. 5,000,000. Show that he can rebalance at zero net cost after the change in composition.

4. Consider the following data.

Company	*Price*
Maxi	Rs. 125
Mini	Rs. 200
Midi	Rs. 200
Mega	Rs. 500

Take the case of an equal weighted index on the above stocks. An investor has formed a tracking portfolio by investing Rs. 5,000,000. The following day, the prices of the stocks are as follows.

Company	*Price*
Maxi	Rs. 125
Mini	Rs. 250
Midi	Rs. 250
Mega	Rs. 625

Show that the investor can rebalance at zero net cost.

ENDNOTES

1. Remember that we would have 2000 shares of Atlas Copco after the split.
2. The number of shares of the ith stock, is once again given by

$$\frac{Q_i}{\sum P_i Q_i} \times W.$$

I

APPENDIX

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The McGraw-Hill Companies

II

APPENDIX

Solutions to End-of-Chapter Exercises

Chapter 2

1. Rs. 140
2. $ 52.50
3. Rs. 253.91
4. Rs. 122

Chapter 3

1. (a) 45.77% (b) – 53.73% (c) $ 57.14
2. Part (a)

Liabilities	*Assets*
Broker's Loan $ 50,000 Owner's Equity $ 50,000	1,000 Shares @ $ 100 $ 100,000

Part (b)

Liabilities	*Assets*
Broker's Loan $ 50,000 Owner's Equity $ 70,000	1,000 Shares @ $ 120 $ 120,000

Part (c)

Liabilities	*Assets*
Broker's Loan $ 50,000 Owner's Equity $ 30,000	1,000 Shares @ $ 80 $ 80,000

Part (d)
Excess Equity = $ 10,000
Buying Power = $ 20,000

Part (e)

Liabilities	*Assets*
Broker's Loan $ 60,000 Owner's Equity $ 60,000	1,000 Shares @ $ 120 $ 120,000

Part (f)

Liabilities	*Assets*
Broker's Loan $ 70,000 Owner's Equity $ 70,000	1,166.67 Shares @ $ 120 $ 140,000

3. Part (a)

Liabilities	*Assets*
1,000 Shares @ $ 40 $ 40,000 Owner's Equity $ 20,000	Credit Balance $ 60,000

Part (b)

Liabilities	*Assets*
1,000 Shares @ $ 50 $ 50,000 Owner's Equity $ 10,000	Credit Balance $ 60,000

Part (c)

Liabilities	*Assets*
1,000 Shares @ $ 25 $ 25,000 Owner's Equity $ 35,000	Credit Balance $ 60,000

Part (d)

Excess Equity = $ 22,500

Part (e)

Liabilities	*Assets*
1,000 Shares @ $ 25 $ 25,000 Owner's Equity $ 12,500	Credit Balance $ 37,500

Part (f)

Shorting Power = $ 45,000

Liabilities	*Assets*
2,800 Shares @ $ 25 $ 70,000 Owner's Equity $ 35,000	Credit Balance $ 105,000

Chapter 4

1. (a) 100 (b) 118.34 (c) 2.0
   (d) 2.795
2. New Divisor = 3.75
   New Number of Shares = 1,333.33
   Inflow = $ 333,333.33
   Outflow = $ 333,333.33
3. Number of shares of each stock before the change in composition.

Company	*# of Shares*
Everest	5,000
Kailash	5,000
Taragarh	5,000
Sagar	5,000

Number of shares of each stock after the change in composition.

Company	*# of Shares*
Elbruz	5,000
Kailash	2,500
Taragarh	2,500
Sagar	2,500

Inflow = Rs. 2,750,000
Outflow = Rs. 2,750,000

4. Original number of shares of each stock:

Company	*# of Shares*
Maxi	10,000
Mini	6,250
Midi	6,250
Mega	2,500

Number of shares of each stock on the following day:

Company	*# of Shares*
Maxi	11,875
Mini	5,937.50
Midi	5,937.50
Mega	2,375

Outflow = Rs. 234,375

Inflow = Rs. 234,375