Chapter 6

# Valuing the Equities, the
# Firms and the Market

*This chapter examines the theory and the performance of models that can help us value the equities, the firms and the market at large. The chapter is divided into four sections.*

*The first section deals with valuation by the market multiples and finance ratios and examines how price to-earnings (P/E), price-to-book value (P/B), price-to-sales revenues (P/S) and price-to-cash flow (P/CF) ratios can help us in valuing an equity. This is followed, in the second section, by an examination of valuation by cash flow analysis. We look at both, discounted cash flow as well as free cash flow, methods and, for the latter, the practicalities of how they can be used for valuing equities as well as firms. The third section deals with such other valuation strategies as the economic-value-added (EVA) concept and valuation by the call options that have been found to be particularly applicable to the nascent firms that, lacking any established positive cash flows and earnings as yet, defy valuation by the more traditional methods.*

*The fourth and final section puts these ideas together and seeks to extend them to the valuation of the market as a whole and then discusses how the valuation of equity can relate to its price performance in the market.*

## 6.1 Valuation by Multiples and Ratios

### 6.1.1 The Valuation Models

We now come to the question of valuation. This, as a matter of fact, has indeed been the undercurrent of our discussions so far. In an efficient market, for instance, we would expect the price of an undervalued security to rise to the level commensurate with its true economic value. Likewise, when we use the CAPM to identify an under-performing security or portfolio as one with a risk premium below the market risk premium when adjusted for risk, what we basically mean is that its market price is way above its true economic value.

Take, for instance, the CAPM graph for the Dow companies shown in Exhibit 5.22. Of these companies, the ones whose risk-adjusted returns plot above the CAPM's Security Market Line have clearly performed better than the market, while those that plot on this line have performed as well as the market and the remaining have performed poorly. Exhibit 6.1 compares the actual returns on these stocks with the returns expected of them based on the CAPM. We could perhaps identify these over-performers as undervalued, the fair-performers as fairly valued and the under-performers as overvalued. But then, while consistent with the efficient market hypothesis, that returns be received in proportion to the risks taken, this hardly tells us what the exact price should be. Nor does it tell us whether these under-performers will continue to remain so. They may well become over-performers, instead, in order to accomplish mean reversion over the long term.

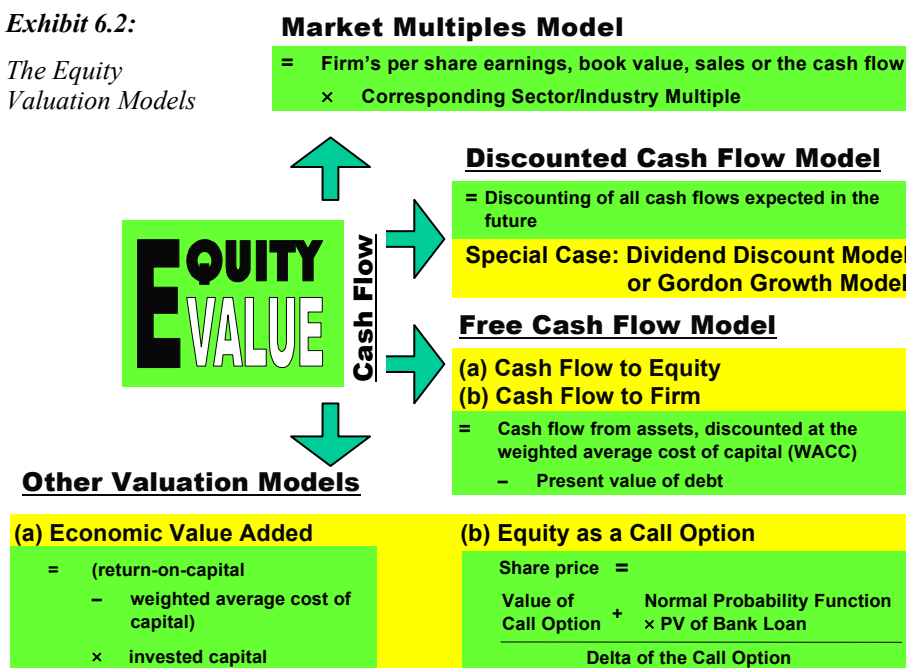***Exhibit 6.1:*** *Using CAPM for relative valuation of the Dow com-panies.*

| | Annual Return* | | | Annual Return* | |
|---|---|---|---|---|---|
| | Actual ( r̄ ) | Expected E(r) | | Actual ( r̄ ) | Expected E(r) |
| **Over-performer [ r̄ > E(r)]** | | | **Average-performer [ r̄ ≈ E(r)]** | | |
| American Express (AXP) | 26.99% | 25.15% | Alcoa (AA) | 24.55% | 26.51% |
| Citigroup (C) | 40.95% | 28.46% | Hewlett-Packard (HWP) | 28.86% | 29.63% |
| ExxonMobil (XOM) | 25.30% | 13.84% | United Techno. (UTX) | 25.63% | 25.93% |
| General Electric (GE) | 32.64% | 26.51% | | | |
| Home Depot (HD) | 33.74% | 23.78% | **under-performer [ r̄ < E(r)]** | | |
| Intel (INTC) | 49.56% | 34.12% | | | |
| Internat. Bus. Machines (IBM) | 35.60% | 28.27% | Boeing (BA) | 12.75% | 14.03% |
| Johnson & Johnson (JNJ) | 23.95% | 15.40% | Caterpillar (CAT) | 13.70% | 18.13% |
| McDonalds (MCD) | 18.46% | 16.57% | Coca Cola (KO) | 16.81% | 17.93% |
| Merck (MRK) | 29.77% | 13.84% | Eastman Kodak (EK) | 9.40% | 12.47% |
| Minn. Mining & Manuf. (MMM) | 16.90% | 12.86% | General Motors (GM) | 20.47% | 23.39% |
| Microsoft (MSFT) | 50.17% | 38.60% | Honeywell (HON) | 20.42% | 23.59% |
| Proctor & Gamble (PG) | 23.25% | 10.52% | J.P. Morgan (JPM) | 29.58% | 34.51% |
| SBC Communications (SBC) | 17.69% | 15.40% | Phillip Morris (MO) | 6.00% | 8.38% |
| Wall Mart (WMT) | 32.91% | 20.86% | Walt Disney (DIS) | 16.96% | 20.08% |

**\*** Actual returns are annualized from 5-year (Jan 1995-Dec 1999) monthly returns, expected returns are from CAPM.

The valuation of a common stock[1] requires consideration, much like any capital asset, of the net benefits that can be derived from owning it. Unfortunately, the full net benefits and their duration are not specified at the time of purchase. Neither do the corporations have to pay dividends on common stocks, nor do the common stocks always appreciate in price, despite all the wishes and prayers of the holders. The task of valuing a stock or the underlying business thus entails gauging the prospective benefits of ownership that the investor is likely to realize in the future. As Exhibit 6.2 shows, there are several ways to accomplish this task[2].

*Exhibit 6.2:*

*The Equity Valuation Models*

**Market Multiples Model**

= Firm's per share earnings, book value, sales or the cash flow
× Corresponding Sector/Industry Multiple

**EQUITY VALUE**

Cash Flow

**Discounted Cash Flow Model**

= Discounting of all cash flows expected in the future

Special Case: Dividend Discount Model or Gordon Growth Model

**Free Cash Flow Model**

(a) Cash Flow to Equity
(b) Cash Flow to Firm

= Cash flow from assets, discounted at the weighted average cost of capital (WACC)
− Present value of debt

**Other Valuation Models**

(a) Economic Value Added

= (return-on-capital
− weighted average cost of capital)
× invested capital

(b) Equity as a Call Option

Share price =

$$\frac{\text{Value of Call Option} + \text{Normal Probability Function} \times \text{PV of Bank Loan}}{\text{Delta of the Call Option}}$$

## 6.1.2 Valuation by the Market Multiples

Perhaps the simplest and the best known of these is the use of such market multiples as price to-earnings (P/E), price-to-book value (P/B), price-to-sales revenues (P/S) and price-to-cash flow (P/CF) ratios. Recall the use of P/E ratio in a series of commercials for the discount brokerage giant, Charles Schwab, for instance (Box 6.1).

The idea here is that a company would average the same price-to-earnings and the like valuation ratios[3] as the peers in its industry. Let $E_X$ denote the earnings, per share, of a company X the price $P_X$ of whose shares

*P/E ratio is the most commonly understood and popularly cited measure of valuation*

we wish to estimate and $(P/E)_{average}$ the average price-to-earnings ratio of the industry that this company belongs to. In that case,

$$P_X \quad = \quad E_X \times (P/E)_{average} \qquad\qquad (6.1)$$

i.e., we have implicitly assumed that $(P_X/E_X) = (P/E)_{average}$.

The problem, then, is to determine what average value to use for the selected multiple and how. Two alternatives are available for this purpose:

— Identify the multiple and use for its average estimate the sector or industry average that can be freely obtained from such popular sites as yahoo.com, multexinvestor.com, quicken.com, morningstar.com, cnbc.com, and the like.

— Identify the multiple and the factors that govern its variation, quantitatively relate the multiple and these governing factors, and then use this relationship and the values of these factors for the equity under consideration to derive the average value of the multiple that would be relevant to that equity's valuation.

By way of illustration[4], let us consider the examples of Microsoft (MSFT), United Technologies (UTX) and Eastman Kodak (EK), each representing one of the three performance based groups in Exhibit 6.1. The details of estimating the share prices for these three companies are summarized in Exhibit 6.3. Here, panel (a) summarizes the relevant per share data for these three companies, panel (b) the corresponding valuation ratios, and panel (c) the share prices computed using these data. For instance, panel (a) shows that Microsoft Corporation's past twelve months' earnings are $1.81 per share, and panel (b) shows the average P/E ratio of 43.20 for its industry in this period. Multiplying the two numbers then gives the estimate of $78.19 as Microsoft's share price. This is given in panel (c).

*Exhibit 6.3:*

*An example of valuation by the market multiples (data as of July 2001)*

| | Microsoft | United Techno-logies | Eastman Kodak |
|---|---|---|---|
| Earnings (ttm) | $1.81 | $3.68 | $4.16 |
| Book value (mrc) | $9.01 | $15.74 | $11.47 |
| Sales revenues (ttm) | $4.43 | $52.96 | $46.07 |
| Cash flow (ttm) | $1.95 | $5.53 | $7.21 |
| Recent share price | $68.80 | $73.50 | $48.85 |

(b)  Valuation ratios for the three companies in panel (a) and the corresponding ratios for the respective industries and the whole market (S&P-500)

| Ratio | Microsoft | | United Technologies | | Eastman Kodak | | S&P 500 |
|---|---|---|---|---|---|---|---|
| | Company | Industry | Company | Industry | Company | Industry | |
| price-to-earnings | 37.99 | 43.2 | 19.97 | 34.7 | 11.75 | 11.7 | 28.18 |
| price-to-book | 7.64 | 8.76 | 4.67 | 8.47 | 4.26 | 4.14 | 6.09 |
| price-to-sales | 15.52 | 12 | 1.39 | 3.33 | 1.06 | 1.03 | 4.02 |
| price-to-cash flow | 35.28 | 36.72 | 13.29 | 21.82 | 6.77 | 6.67 | 20.91 |

(c)  Share prices computed using the market multiples in panel (b) and equation (6.1)

e.g., for Microsoft,
P = $1.81 x 43.20
= $78.19
from company earnings
and the industry P/E.

| | Microsoft | United Tech. | Eastman Kodak |
|---|---|---|---|
| *Estimated from the price-to-earnings ratio* | $78.19 | $127.70 | $48.67 |
| *price-to-book value ratio* | $78.93 | $133.18 | $47.49 |
| *price-to-sales ratio* | $53.16 | $176.36 | $47.45 |
| *price-to-cash flow ratio* | $71.60 | $120.66 | $48.09 |

Two advantages of using the ratios, instead of using CAPM to separate over-performers from the under-performers and hoping that either the former will continue the same way or the latter will reverse their past pattern, are immediately obvious in panel (c), Exhibit 6.3. One, we now have some numbers for the prices, which can help us identify the under-priced stocks that we may wish to acquire. For instance, the results in Exhibit 6.3 show that, on average, Eastman Kodak is correctly priced whereas Microsoft is slightly under-priced and United Technologies is way under-priced. Two, instead of CAPM's bland look at an equity's price-performance, we have now looked at the factors like earnings, book value, sale revenues and cash flow that actually facilitate that performance. In the process, we have also incorporated the fact that all the industry sectors of the market do not grow at the same rate and time. Eastman Kodak no longer appears as unattractive a "buy" as it did in Exhibit 6.1, nor does Microsoft appear as attractive a "buy" now as the data in that Exhibit made it seem.

If we divide a firm's price-to-book value (P/B) ratio by the corresponding price-to-earnings (P/E) ratio, then we get another popular valuation tool: the firm's ROE (return-on-equity), i.e.,

$$\frac{\text{price-to-book value (P/B) ratio}}{\text{price-to-earnings (P/E) ratio}} = \frac{\text{price/book value per share}}{\text{price/earnings per share}}$$

$$= \frac{\text{earnings per share}}{\text{book value per share}} \qquad (6.2a)$$

$$= \frac{\text{earnings available for common stock}}{\text{total equity}}$$

Therefore,

$$\frac{\text{price-to-book value (P/B) ratio}}{\text{price-to-earnings (P/E) ratio}} = \boxed{\textbf{Return-on-equity (ROE)}}$$

Though strictly an accounting number that basically measures a firm's profitability or managerial effectiveness, investors often use ROE as an equity-selection criterion. The problem is that high rates of growth in earnings often translate into faster appreciation in share prices, so raising the ROE. For an investor buying the share of a high ROE firm, then, the question is whether a good firm invariably makes an equally good stock and, more often than not, the answer is in the negative. What exacerbates this problem is the fact that ROE rises with the debt-equity ratio so long as returns on the firm's investments exceed the interest on its debt. This is because,

$$\text{return-on-equity (ROE)} = \frac{\text{earnings available for common stock}}{\text{total equity}}$$

$$= \frac{\text{net income}}{\text{total assets}} \times \frac{\text{total assets}}{\text{total equity}} \qquad (6.2b)$$

$$= \text{return-on-assets (ROA)} \times \text{equity multiplier}$$

where

$$\text{equity multiplier} = \frac{\text{total equity} + \text{total liability}}{\text{total equity}}$$

$$= 1 + \frac{\text{total debt} + \text{other liabilities}}{\text{total equity}}$$

$$= 1 + \text{debt ratio} + \frac{\text{other liabilities}}{\text{total equity}}$$

Obviously, if debt is the main liability then the larger the debt the greater the liability-equity ratio will be, and so will the equity multiplier and the ROE, even if the return-on-assets (ROA) remains the same. Thus, as can be seen in Exhibit 6.4 where we compare these statistics for the three companies examined in Exhibit 6.3, the greater a firm's debt-to-equity ratio the greater the equity multiplier by which its ROE rises over the ROA[5].

**Exhibit 6.4:** *Profitability and liquidity ratios for the companies compared in Exhibit 6.3*

| | Microsoft | | United Tech. | | Eastman Kodak | | S&P 500 |
|---|---|---|---|---|---|---|---|
| | Company | Industry | Company | Industry | Company | Industry | |
| return-on-assets [‡] | 24.86 | 15.13 | 6.38 | 4.49 | 7.28 | 7.1 | 8.33 |
| return-on-equity [‡] | 35.09 | 27.82 | 22.27 | 25.22 | 26.62 | 25.88 | 22.16 |
| debt-equity ratio [§] | 0.00 | 0.08 | 0.60 | 3.04 | 1.18 | 1.18 | 0.99 |

[‡] 5-year average

[§] the most recent quarter

The alternate, more quantitative, approach to equity valuation by the market multiples requires

- identifying the principal factors or primary variables that govern the changes in a multiple,
- establishing their precise relationship, say by using multiple regression analysis,

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- estimating what the value of the multiple should be, based on this relationship, for the current values of these principal factors or primary variables, and
- examining how this value compares with the current value of that multiple.

Take Damodaran's[6] approach to P/E estimation, for instance. It is based on the premise that the P/E ratio is affected most by the expected growth in earnings, the payout ratio and the CAPM-based beta of an equity and therefore uses these measures as independent variables, and P/E ratio as the dependent variable. In July 2001, his web-site[7] gave the following multiple regression equation for the dependence of P/E ratio on estimated corporate earnings growth over the next five years, current payout ratio, and beta for the past five years:

$$(P/E)_{regression} = 145.32 \times \left[ \begin{array}{c} \text{expected earnings growth} \\ \text{for the next 5 years} \end{array} \right]$$

$$+ \ 3.2 \ \times \ \left[ \begin{array}{c} \text{payout ratio} \\ \text{(most recent year)} \end{array} \right] \ + 2.37 \times \text{beta}$$

(6.3a)

when the regression line is forced through the origin, i.e., intercept = 0. This is because a P/E ratio can hardly exist if the other fundamentals vanish.

We can now use the following version of Equation (6.1) for the valuation of our stock X:

$$P_X = E_X \times (P/E)_{regression}$$

(6.3b)

Exhibit 6.5 illustrates the use of this strategy to value the three stocks — Microsoft, United Technologies and Eastman Kodak — that we examined earlier in this section. Except for United Technologies, these estimates are of about the same order as in Exhibit 6.3. Even for United Technologies, an earnings growth at the sector average rate of 20% will raise the estimate of its

| *Exhibit 6.5:* <br> *Equity valuation by (P/E)$_{regression}$ method* | **Microsoft** | **United** <br> **Technologies** | | **Eastman** <br> **Kodak** |
|---|---|---|---|---|
| *Expected earnings growth\** | 25% | 15% | 20% | 6% |
| *Payout ratio* | 0% | 21.70% | 21.70% | 42.12% |
| *Beta* | 1.8 | 1.15 | 1.15 | 0.46 |
| *(P/E)regression based on equation (3.13a)* | 40.6 | 25.22 | 32.48 | 11.16 |
| *Earnings (annual, last twelve months)* | $1.81 | $3.68 | $3.68 | $4.16 |
| *Price, estimated from equation (3.13b)* | $73.48 | $92.80 | $119.54 | $46.41 |

*\*The values used here are the analysts' estimates.*

$(P/E)_{regression}$ to 32.48, and its price to \$119.54, or about the same as in Exhibit 6.3. This is because, as can be seen in Equation (6.3a), the estimation of $(P/E)_{regression}$ is far more sensitive to the rate of expected growth in earnings than to the other two independent variables here.

Damodaran also reports the results of similar multiple regression analyses for the other equity multiples used in Exhibit 6.3. The data for two of them are reproduced below, mainly in order to complete the picture and to show that an analytically rigorous and data-adaptive alternative to our simplified use of market multiples does indeed exist.

$$(P/B)_{regression} = 4.97 \times \left[ \begin{array}{c} \text{return on} \\ \text{equity} \end{array} \right] - 0.05 \times \left[ \begin{array}{c} \text{payout} \\ \text{ratio} \end{array} \right] \tag{6.3c}$$
$$+ 0.85 \times \text{beta} + 8.97 \times \left[ \begin{array}{c} \text{expected growth} \\ \text{in earnings} \end{array} \right]$$

and

$$(P/S)_{regression} = 16.17 \times \text{margin} - 0.59 \times \left[ \begin{array}{c} \text{payout} \\ \text{ratio} \end{array} \right] \tag{6.3d}$$
$$- 0.44 \times \text{beta} + 7.60 \times \left[ \begin{array}{c} \text{expected growth} \\ \text{in earnings} \end{array} \right]$$

Another aspect of the predictive power of financial ratio analysis was demonstrated in William Beaver's pioneering comparison[8] of selected financial ratios of 79 firms that failed with an equal number of firms that remained solvent. As can be seen from Exhibit 6.6, which summarizes the main results of this study, Beaver found that the businesses that failed carried an unmanageable debt burden, relative to cash flow and assets, and lower returns on sales and assets. The results of this study, replicated in several similar studies since it was first reported thirty-five years ago, brought out the following signs of failing businesses at least three years before they actually failed:

- dwindling to negative cash flow and net income, relative to total debt,
- dwindling net working capital, relative to total assets, and
- total debt approaching total assets.

Interestingly, these are precisely the reasons why the once booming dot.coms of the late 1990s would disappear almost 35 years to the date. Some lessons are clearly never learned, despite the considerable advances that have been made since Beaver's study, particularly in using the quantitative models to predict business failures by combining several financial ratios. For instance,

***Exhibit 6.6:*** *Beaver's classic study identified large debt, in terms of cash flow and assets, and lower returns on sales and assets as the guaranteed recipes for business failure.*
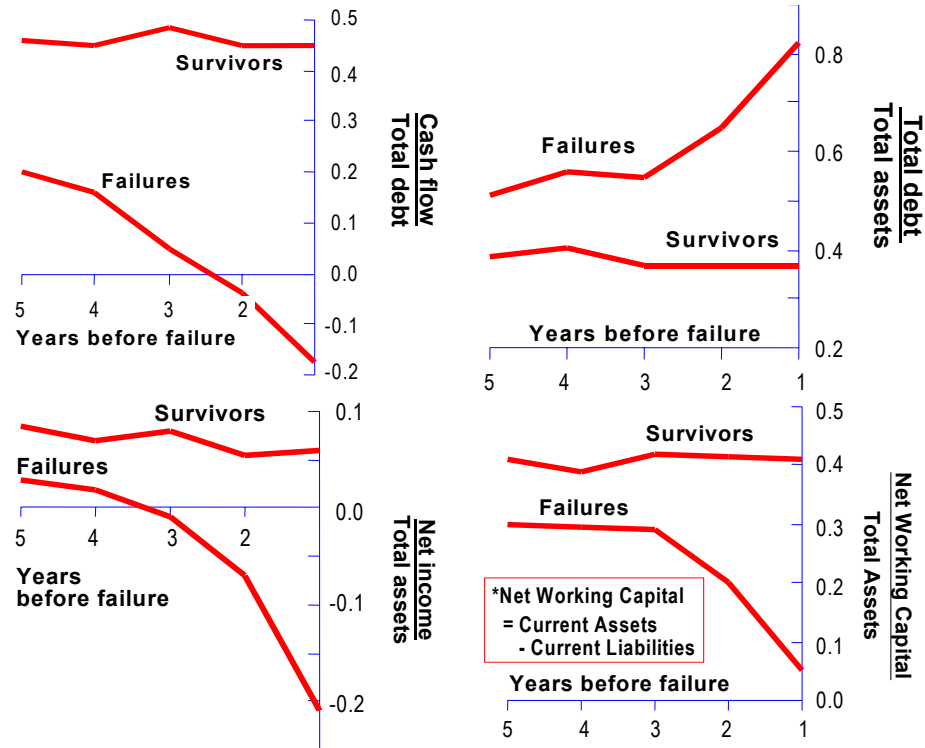


take the pioneering quantitative model of Altman[9], and its modification by Dambolena and Khoury[10] who added to Altman's multiple discriminant analysis model the volatility of ratios prior to business failure. By way of illustration, the Dambolena-Khoury model computes the Z-score of a firm, a measure of its survival prospects, as

$$
\begin{aligned}
Z \;=\; & 1.189 - 8.436 \times \frac{\text{Net profit}}{\text{sales}} + 18.850 \times \frac{\text{Net profit}}{\text{total assets}} \\[2mm]
& + 1.955 \times \frac{\text{Fixed assets}}{\text{net worth}} + 0.739 \times \frac{\text{Funded debt}}{\text{net working capital}} \\[2mm]
& - 4.921 \times \frac{\text{total debt}}{\text{total assets}} - 1.588 \times \frac{\text{Inventory standard deviation}}{\text{net working capital}} \\[2mm]
& - 6.330 \times \frac{\text{Fixed assets' Standard deviation}}{\text{net worth}} \qquad\qquad (6.4)
\end{aligned}
$$

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The idea here is that, as Altman had initially pointed out, a low value of Z is deleterious to a firm's health. Specifically, in Altman's initial model,

— if Z < 1.8, the firm will fail,
— if $1.8 \leq Z \leq 3$, the firm will not likely fail, and
— if Z > 3, the firm will not fail.

Integrating and analyzing the financial ratios has been a much-studied area of firm-valuation, of course, particularly because investment firms need to constantly monitor if the businesses that they have invested in are likely to survive. Recent corporate problems such as those related to the bankruptcies of Enron and WorldCom have emphasized the importance of this analysis further. Our above discussion only provides a sample of this rather complex area, therefore, and seeks mainly to help the investors understand how diverse factors can be incorporated into making intelligent choices of stocks for their portfolios. Interested readers may wish to browse a book like that by Foster[11] for a detailed exploration of this issue.



"... and that's why you need to raise my allowance!"

SPENDING = GROWTH
GROWTH = JOBS
JOBS = SECURITY
SECURITY = HAPPINESS

—GLASBERGEN—

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## 6.2    Valuation by cash flow analysis

Compared to the market multiples and financial ratios, though, cash flow analyses have offered, over time, far more powerful and versatile tools for equity valuation. In the ultimate analysis, the survival of a firm depends on the cash flow that it can continue to generate, after all. Likewise, as for the investor, the value that the equity of a firm carries depends primarily on the cash flow that it promises to generate. Two alternatives are available here: (a) discounted cash flow models and (b) free cash flow models.

### 6.2.1   The Discounted Cash Flow Model

This method is typically used for valuing the companies that pay dividends. In general, the holder of a common stock expects to receive net benefits as dividends and/or capital gains. Although neither of these can be predictable with certainty, least of all the latter, investors do form reasonable expectations that can be quantified. Simply stated, the present value of these expected benefits is a stock's intrinsic value. Given efficient equity markets, this intrinsic value should equal the stock's market price. We can therefore write equation (3.4) as

$$P_0 \;=\; [D_1 + E(P_1)]/(\,1+k_e) \tag{6.5a}$$

where $P_0$ is stock's price at time $= 0$, $E(P_1)$ the expected price after 1 period, $D_1$ is the dividend payment in this period and $k_e$ is the cost of equity to the firm or the required rate of return on the stock that prevents its market value from falling. Suppose the stock is to be held for n number of periods. If the cost of equity per period, $k_e$, remains constant, then we have

$$P_0 \;=\; \sum_{t=1}^{n} \frac{D_t}{(1+k_e)^t} \;+\; \frac{E(P_n)}{(1+k_e)^n} \;\approx\; \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t} \tag{6.5b}$$

when $n \rightarrow \infty$, i.e., the stock is held over the expected infinite length of a corporation's life.

Thus, in this **discounted-cash-flow (DCF) formula** for the present value of a stock, the price in any period is obtained by discounting to that period dividends and capital gains received in the subsequent period. Notice how the term containing $E(P_n)$ in Equation (3.15b) vanishes for an infinitely long time-horizon because $(1+k_e)^n \rightarrow \infty$ and $1/(1+k_e)^n \rightarrow 0$ as $n \rightarrow \infty$. In effect, therefore, we are pricing the stock in Equation (6.5b) solely by discounting the future dividend stream to its present value. This method of stock pricing is therefore known as the **dividend discount model**.

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Predicting the future values of $D_t$ is not an easy task, however, and verges on the impossibility. Some simplifications can be sought, nonetheless. At its simplest, for instance, let us assume that a constant dividend is being paid out every year, starting next year, i.e., $D_t = D_1$. In that case,

$$P_0 \;=\; D_1/k_e \tag{6.5c}$$

because this is the case of a simple perpetuity[12].

Suppose $D_t$ is not a fixed amount but grows, instead, at the constant rate g every year, i.e.,

$$D_{t+1} \;=\; (1+g) \times D_t,$$

$$D_{t+2} \;=\; (1+g) \times D_{t+1} \;=\; (1+g)^2 \times D_t \quad \text{and so on.}$$

Equation (6.5c) then modifies[13] to

$$P_0 \;=\; \frac{D}{(k_e - g)} \tag{6.5d}$$

Recall that we have earlier used this model in Box 3.1, where an alternative method of deriving this equation was presented.

This constant growth dividend discount model is the well-known ***Gordon growth model***, having been popularized by Myron Gordon[14] in the late 1950s. Although widely used in practice, using Equation (6.5d) is hardly as problem-free as its simple appearance suggests, as we saw in Box 5.3. A more complete form of it is derived in Box 6.2. This still shows valuation to be a speculative exercise, however, because we now need to fix the holding-period for the stock that we seek to value!

**Box 6.2: The correct form of Gordon Growth Equation**

Suppose that, at some starting point $t = 0$, dividend $D = D_0$ and price $P = P_0$, and that the firm sets its dividend policy as payout ratio = $p = D_0/P_0$. Let us also suppose that these dividends are to grow at a steady rate of g per period into the foreseeable future, i.e.,

$$D \;=\; D_0 \exp(gt) \;=\; pP_0 \exp(gt)$$

Now, as for the firm's price P, we can write its rate of change per period as

$$\frac{dP}{dt} \;=\; rP - D \;=\; rP - D_0 \exp(gt)$$
$$\;=\; rP - pP_0 \exp(gt)$$

where r is the return per period, or the market capitalization rate.

Treating this equation as a linear first order differential equation in P gives its solution as

$$P \;=\; \frac{P_0}{r - g} \,[(r - g - p)\exp(rt) + p\exp(gt)]$$

This should be the correct expression for the dividend discount model for constant payout ratio, dividend growth and capitalization rate.

Several reasons add to the uncertainties in this valuation approach. First of all, for instance, using Equation (6.5d) makes sense only so long as $k_e$

> g because $(k_e - g) \rightarrow 0$ as g approaches $k_e$, driving $P_0$ to infinity. Likewise, Equation (6.5d) is of little use for valuing a firm that does not pay dividends unless dividend is a proxy for earnings. How about the relatively mature firms that have slow growth rates and pay dividends regularly (i.e., the so-called "income" stocks)? Uncertainties abound there as well, thanks to the simple fact that, however well informed, the data on future rates of dividends ($D_t$), returns ($k_e$) or the cost of equity, and growth (g) that we need here are largely matters of speculation. Above all, as we saw in Box 5.3, Equation (3.15d) fails when ($k_e - g$) is not a constant. Likewise, its more complete version in Box 6.2 fails when we note that it was derived by assuming that the payout ratio is constant. This is not the case, in reality, as has been discussed earlier elsewhere.

Despite these limitations, this simple method of valuation often works reasonably well for relatively mature companies, as the following example of United Technologies Corporation (NYSE: UTX) demonstrates. One of the 30 companies that comprise the "Blue Chip" Dow Jones Industrial index, UTX is a conglomerate comprising four principal operating segments — Otis (elevators and escalators), Carrier (heating, ventilating and air conditioning systems), Pratt and Whitney (aircraft engines and space propulsion) and Flight Systems (helicopters, propeller and electrical systems). As we saw earlier, its risk adjusted return plots exactly on the security market line. With the $\beta$ value of 1.15, the company has consistently given investors returns superior to the market. Not surprisingly, therefore, a $10,000 investment in UTX in January, 1970, would be worth $1.32 million in May, 2001, assuming an automatic reinvestment of dividends, compared to $460,000 in the S&P-500 total return index (Exhibit 6.7).
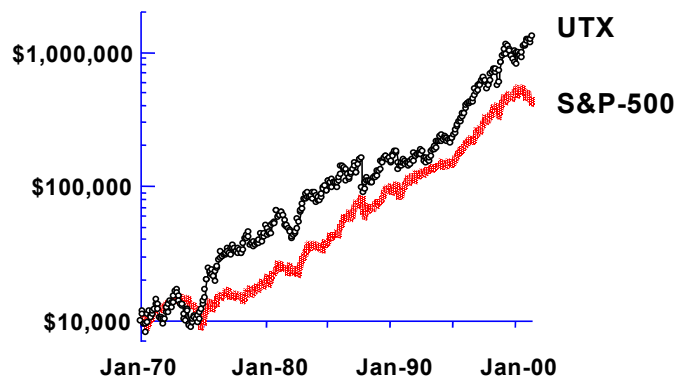


*Exhibit 6.7*

*$10,000 invested in the United Technologies (UTX) in Jan 1970 would have grown to $1.32 billion by the end of May, 2001, compared to $460,000 in the case of S&P-500 total return index.*

Now, we need three sets of estimates in order to use equation (6.5d) to price UTX: its dividend next year ($D_1$), cost of equity ($k_e$) and the growth

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rate (g). Analysts[15] expected a dividend of $0.90 for 2001, based on the company's estimated EPS (earnings per share) value of $4.07 that year, and assuming that its year 2000 payout ratio[16] of 21.70% were to continue. This was a reasonable estimate because UTX is a financially healthy company with a total debt/equity ratio (= 0.60) that was far less than the average of 2.99 for its sector and the S&P-500 companies (= 0.97), that has not been extravagant in its dividend payments. As for $k_e$, let us use the estimate of ~11% from the CAP model, based on (a) the UTX beta of 1.15 for the past 60 months, (b) the 6.06% real annual rate we estimated earlier for market's long-term growth, and (c) a long-term annual inflation (or risk-free) rate of 4.0%. We can thus write

$$k_e \quad = \quad r_i \quad = \quad r_f + \beta \times (r_m - r_i)$$
$$= \quad 4.0\% + 1.15 \times 6.06\% \quad = \quad 10.97\% \qquad (6.6a)$$

As for the remaining number, g, *the sustainable growth rate* is given by

$$g \quad = \quad \textbf{plowback ratio} \times \textbf{return on equity (ROE)} \qquad (6.6b)$$

For UTX, plowback ratio is 78.30% (= 1 − payout ratio = 1 − 21.70%) and the return on equity (ROE) = 22.27%. By plugging these numbers into equation (6.6b), we obtain g = 17.44%. This is the maximum sustainable rate based on the recent history, however, and not necessarily the rate that is likely to be sustained over the infinite time horizon that equation (6.5d) is based on. Note that, while its ROE has averaged 22.27% during 1996-2000, UTX has only managed a dividend growth rate of 9.99% through this period. This is not really surprising because, as we discussed in the previous chapter, recent years have witnessed a marked propensity for the firms to either not pay dividends at all or reduce these payments. As dividends tend to be sticky in that firms seldom lower their historic payout ratios, the best way to lower dividend payments is to reduce their rate of growth. These make assuming a continuation of the past 5 years average of g = 9.99% into the foreseeable a far more realistic proposition, therefore, than using g = 17.44%. Given these numbers, equation (6.5d) yields the estimate of share price for UTX as

$$P_0 \quad = \quad D_1/(k_e - g) \quad = \quad \$0.90/(10.97\% - 9.99\%) \quad = \quad \$91.84 \qquad (6.6c)$$

Notice how close this estimate is to our earlier estimate in Exhibit 3.44. For comparison, in July 2001, the Morningstar business appraisal for UTX was $91.62 (June 20, 2001), Quicken's valuation was $101.26 and,

based on estimates by 14 financial analysts, Yahoo Finance cited a 12-month target price of $85-95 for UTX!

Applying this valuation method to Eastman Kodak, its beta of 0.46 (Exhibit 6.5) corresponds to $k_e = 6.79\%$, from Equation (3.16a). Its dividend has grown at the same annual rate of 1.92% for the past five years as the average for its industry. Thus, taking g = 1.92% for this company, and noting that its dividend payment for the year 2001 was at $1.76, Equation (6.5d) yields the estimate for Eastman Kodak's shares as $36.14. Of all the valuation methods that we have tried as yet, this is by far the lowest estimate for Eastman Kodak shares.

Apart from the derivation in Box 6.2, one can think of several modifications or innovations to equation (6.5d) that can broaden its applicability. For instance, we could use current year's dividend ($D_0$) instead of next year's estimate $D_1$, by writing $D_1 = D_0 \times (1+g)$, and then divide both the sides by the current year's earnings per share ($E_0$). This yields

$$P_0/E_0 \quad = \quad D_0/E_0 \quad \times \quad \frac{1 + g}{k_e - g} \tag{6.7a}$$

where ($P_0/E_0$) is our familiar P/E ratio and ($D_0/E_0$) is the payout ratio. For the above values of $k_e$, g and the payout ratio, this gives P/E ratios of 21.52 for UTX and 8.81 for EK. For the earnings data given earlier, these correspond to the share prices of $79.19 for United Technologies and $36.65 for Eastman Kodak.

### 6.2.2    The Free Cash Flow Model:

Notice that we have, in using these variations of the Gordon Growth or Dividend-Discount models, been unable to value a company like Microsoft that has paid no dividends until recently. Two added limitations of these models must already be apparent. The dividend based models are not only hard to apply when a company pays no dividend but also when growth exceeds the cost of capital, simply because the price estimate remains positive only so long as $k_e$ exceeds g and shoots through the ceiling when g approaches $k_e$! Likewise, how would we use a market multiple like the P/E ratio to value a firm that is yet to turn in positive earnings?

One solution lies in using the cash flow instead of dividends. This is because, irrespective of whether a company pays dividends or not, its cash flow affects its solvency and growth potential. There are two kinds of cash flow[17] measurements, in the main: simple cash flow and free cash flow. What is the difference? The simple cash flow is literally the cash that flows through the company's account and is otherwise known as EBITDA, for *earnings*

*before interest, taxes, depreciation and amortization*. It is also roughly estimated by adding net profits after taxes to depreciation. This measure is best used when we wish to value companies with considerable capital expenditure up-front, or with significant amortization burdens. Huge depreciation and amortization changes often mask a firm's ability to generate cash, as does the tax rate if it changes drastically from one year to another, so impacting the current and future earnings. Free cash flow, on the other hand, is a measure of what a firm can pay as dividends, even when it does not. Not all the earnings go to equity, after all, so that a firm's cash flow will be positive even if its cash flow to equity is negative. Depreciation is not a cash flow to equity, for instance, and only affects a firm's cash flow for tax purposes. Note, also, that net cash flow to equity is net of debt related expenses as well. A narrow view even holds that dividends and stock buy-backs comprise the only cash flow to equity.

Free cash flow analysis thus enables two kinds of valuation models:

– Equity valuation is based on free cash flow to equity (FCFE): Only the cash that can flow to equity is considered here.

– Firm valuation is based on the free cash flow to the firm (FCFF): This uses all the free cash flow to the firm, including the cash flow generated from capital raised in the debt market, which must be excluded in the case of equity valuation.

These two types of free cash flow are computed as follows:

| Free Cash Flow to Firm (FCFF) | = | Earnings Before Interest and Taxes (EBIT) $\times (1 - \text{Tax Rate})$ |
|---|---|---|
| | | – (Capital Expenditure – Depreciation) |
| | | – Change in Working Capital |

and                                                                                    (6.8a)

| Free Cash Flow to Equity (FCFE) | = | Free Cash Flow to Firm (FCFE) |
|---|---|---|
| | | – Debt $\times (1 - \text{Tax Rate})$ |

For purposes of equity valuation, if we expect the firm to grow steadily at rate g into the foreseeable future, then, analogous to Equation (6.5d), its valuation equation can be now written as follows:

$$P_0 \approx \frac{FCFE_1}{k_e - g}$$                                              (6.8b)

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Likewise, as for valuing the firm, the form analogous to Equation (6.5b) is

$$\text{Value of the Firm (V)} \approx \sum_{t=1}^{\infty} \frac{FCFF_t}{(1+k_{wacc})^t} \qquad (6.8c)$$

Where $k_{wacc}$, the weighted average cost of capital, is computed as

$$k_{wacc} = k_e \times \frac{Equity}{Debt + Equity} + r_{debt} \times (1 - \text{Tax Rate}) \times \frac{Debt}{Debt + Equity}$$

with $r_{debt}$ as the average rate on the firm's debt.

Estimating cash flow to the firm over its infinitely long life is hardly a practical proposition, of course. This requires using a multi-period approach, with different growth rates for different phases. The simplest of them is the two-period model. In this case, we would

– use the appropriate version of Equation (6.8) for the initial period of relatively robust growth, say for n number of years, and

– assume a steady growth forever, at the same rate as the market, for the subsequent period and discount it to the present.

Equation (6.8c) thus modifies to:

$$\text{Value of the Firm (V)} \approx \sum_{t=1}^{n} \frac{FCFF_t}{(1+k_e)^t} + \frac{FCFF_n}{(k_{wacc} - g_n)\,(1+k_e)^n} \qquad (6.8d)$$

The initial high growth period, usually 10 years

The subsequent period of stable growth forever

What should be this growth rate $g_n$? The common practice is to use the 5% long-term nominal growth rate in the U.S. As nominal growth rate of the world economy is also about the same, this rate is almost a 'universal' for any mature or stable firm nominal growth. Obviously, if we are dealing with a firm that is already in this stable-growth mode, then we need to simply set $n = 0$ in Equation (6.8d). Only its second part will then remain, reducing it to the same form as Equation (6.8b), so long as we replace $FCFE_1$ by $FCFF_1$. Stable growth firms tend to be of average risk (i.e., beta = 1) and highly leveraged, pay high dividends, have low net capital expenditure, and earn about the same return on capital (ROC)[18] as $k_{wacc}$, the weighted average cost

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of capital. In contrast, the high growth firms tend to be of above-average risk, pay little or no dividends, have high net capital expenditure, carry little or no debt, and earn excess return (i.e., high ROC). Such patterns are hard to sustain over a protracted period of time, however. Oftentimes, the valuation of such firms and their equities is carried out using a three-stage model. The common practice in this case is to assume an initial period of high growth, followed by a transition period when the high growth rate declines to the stable growth rate, and finally, the stable growth phase of keeping up with the market forever. Usually, the larger the firm the shorter its high growth phase is likely to last, but the higher the current growth rate the longer this growth period may last. Add to this the business strategies, barriers to entry and differential advantages. The stronger the firm is in these respects, the longer the high growth period is likely to last.

Equations, (6.8c) and (6.8d), are far more versatile than they seem in that they can be conveniently used for equity-valuation as well. Just subtract the market value of debt from the value of the firm thus derived and divide the resulting figure by the number of shares outstanding.

We are now adequately equipped to use cash flow analysis for valuing Microsoft. With 5.38 billion shares outstanding, the mid-year 2001 share price of $68.80 gives Microsoft the market capitalization of $370 billion. For fiscal year ended June 30, 2001, Microsoft had income of $7.35 billion on revenue of $25.3 billion, compared to the fiscal 2000 income of $9.42 billion on revenue of $22.96 billion. This drop includes $2.62 billion investment losses, however, and reflects the general market conditions that have already persisted for more than a year now. Before the June 30, 2001 report, the company's trailing twelve months EBITDA was $12.2 billion, with $10.1 billion available to common. But Microsoft's free cash flow is vastly different from the reported net income. Much like most of the high growth companies, particularly in the technology sector, and virtually all Microsoft employees receive stock options. To offset the dilution effect of the options, the company spends a large portion of net income on buying back the shares. The result of these and related expenses is that Microsoft's price-to-free cash ratio was at 27.27 in June 2001 (or $2.57 per share), compared to its price-to-cash flow ratio of 35.28. Otherwise, a totally debt-free business like Microsoft should receive the same return on assets as on equity.

We now need to estimate the rate at which this cash flow will grow in the foreseeable future and the rate at which this cash stream is to be discounted to the present. Microsoft's earnings have averaged an impressive 35% annual growth during 1995-2000. This high growth rate and Microsoft's singular domination of the market favor a prolonged period of high growth.

The problem is that it may already be too large to continue being the innovator that it once was. Indeed, the resulting barrier to competitors' entry was the crux of government's case against Microsoft. Recall the coincidence, albeit an eerie one, that the technology sector's currently continuing slump began, almost to the day, with Judge Jackson's ruling against Microsoft. The hands that were invisible to Adam Smith truly work in mysterious ways!

For our valuation exercise, these factors favor using a multi-period model. Let us, for simplicity, we use a two-period model by assuming the continuation of the present growth rate until 2010 and a stable phase thereafter. For the rate in this high growth phase, we could assume the same value as the past five years' ROE (= 22.77%), by using a plowback ratio of 1. But this rate is excessive, particularly as the PC (personal computer) market is fast approaching saturation. To err on the cautious side, therefore, let us use the consensus estimate of 15% that analysts usually cite for the future growth in Microsoft's earnings. As for the discount rate, Microsoft's beta of 1.8 gives the estimate of 14.8%, i.e., about the same as this 15% growth rate.

The value for stable phase, or the terminal value, is the second part of Equation (6.8d) and is even easier to compute. Let us assume that Microsoft will enter this phase in 2010, after which its stock will move perfectly with the market. Let us also assume, for simplicity, that Microsoft's present capital structure (i.e., debt ratio = 0) will remain unchanged. Therefore, for beta = 1, we now have $k_e = 10\%$ for this phase and assume $g = 5\%$, the historic nominal growth rate for the economy. As for discounting to the present value, we will use the same discount rate as in the 2001-2010 phase.

Exhibit 6.8 summarizes the resulting numbers and computations. For the two-stage model used here, the 2001-2010 yearly PVs (present values) for free cash flow add up to $25.70 while the 2010 terminal value for post-2010 steady-growth performance has the 2001 value of $51.40. We would thus price the Microsoft shares at $77.10 by adding these two numbers. Note that it makes no difference as to what rate is assumed for the growth phase, so long as we use the same rate for discounting to compute the PV.

What if Microsoft did not grow at its 1995-2000 above-the-market rate and grew at the market rate instead? We would then ignore the first part of the computation in Exhibit 6.8 and use the estimate of 2001 terminal value (= $51.40 = $2.57/\{0.10 – 0.05\}$) for Microsoft's current share price. Can this be a practical proposition? Quite plausibly, particularly as it does not necessarily imply consigning a star performer of recent years, and one of the world's leading companies, to the status of a laggard. The looming prospects of economic slowdown in the U.S. and elsewhere can accomplish that. Obviously, at the 52-week low of $40.25 on December 21, 2000, Microsoft shares offered the 'buy' opportunity that value investors are unlikely to

receive for a long time. Thus, despite the market's prolonged, bear-run, the Microsoft share prices have held remarkably steady above that level.

***Exhibit 6.8:*** *Valuing the Microsoft shares by free cash flow analysis*

<u>***Assumptions:***</u>

(a) The present high growth phase will continue, despite the ongoing economy-wide slump, until 2010 after which growth will stabilize at the broad market rate. Microsoft's present capital structure will remain unchanged (i.e., no debts and dividends) throughout.

(b) During the growth phase (2001-10), per share FCFE grows at the annual rates of 10%-15%. Let the cost of equity, for discounting to the present value, be the same. Thus, the 2001 PV of each year's FCFE will then be the same as in 2001.

(c) During the stable phase (i.e., after 2010), the 2010 per share FCFE grows annually at the 5% nominal rate of overall economy. The cost of equity is the same as the historic 10% rate of the overall market, and is discounted from 2010 to 2001 at the 10%-15% rate of growth, as assumed.

| per share data | FCFE for the growth rate of | | | PV of FCFE |
|---|---|---|---|---|
| | 15% | 12.50% | 10% | |
| (a) *the 2001-10 growth phase* | | | | |
| 2001 | $2.57 | $2.57 | $2.57 | $2.57 |
| 2002 | $2.96 | $2.89 | $2.83 | $2.57 |
| 2003 | $3.40 | $3.25 | $3.11 | $2.57 |
| 2004 | $3.91 | $3.66 | $3.42 | $2.57 |
| 2005 | $4.49 | $4.12 | $3.76 | $2.57 |
| 2006 | $5.17 | $4.63 | $4.14 | $2.57 |
| 2007 | $5.94 | $5.21 | $4.55 | $2.57 |
| 2008 | $6.84 | $5.86 | $5.01 | $2.57 |
| 2009 | $7.86 | $6.59 | $5.51 | $2.57 |
| 2010 | $9.04 | $7.42 | $6.06 | $2.57 |
| SUM of the 2001 PVs = | | | | $25.70 |
| (b) *the post-2010 stable phase* | | | | |
| PV in 2010 | $180.82 | $148.37 | $121.20 | |
| PV in 2001 | $51.40 | $51.40 | $51.40 | |

<u>***Result:***</u>

Tabulated above are the computations based on these assumptions. As DCF method treats share value as the present value of future cash flow, all that we now need to do is add the two PVs, i.e.,

**Microsoft's current share price =**    *Sum of the PVs of annual FCFEs during the growth phase*
       *+ the PV of the FCFEs to be received during the stable phase*

       = $25.70 + $ 51.40 = $77.10

## 6.3    Other Valuation Models

### 6.3.1    Valuing Nascent Enterprises

As our example of valuing the Microsoft shares amply demonstrates, cash flow analysis offers a robust tool to value the firms and their equities, irrespective of whether they pay dividends or not. There is one situation where it may not work as easily, and requires deft projections, however: when the cash flow is negative. This is usually the case with the yet-to-be-profitable start up companies. Take the case of Amazon.com, the online retailer that started selling books in 1995 and generated revenues of $511,000, based on the 2001 first quarter estimates of $700 million, and was expected in mid 2001 to end up with $3.4 billion in revenues for 2001. This averages to a better than four-fold rise each year since inception. As shown in Exhibit 6.9, however, the company was yet to turn profitable although, guessing from the continuation of the trend, it seemed poised to turn that corner soon.
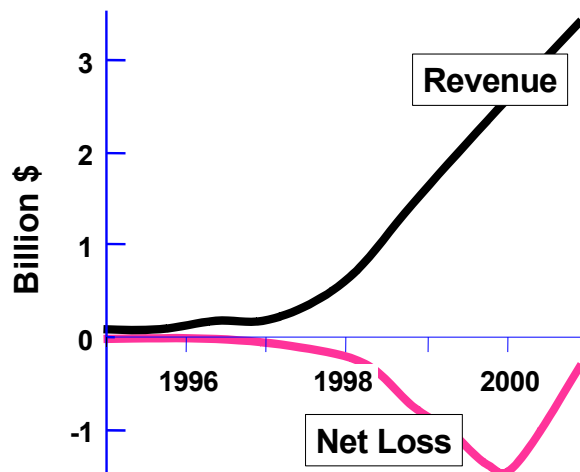
**Exhibit 6.9**

*Amazon.com, the online retailer, has grown dra-matically since it began selling books in 1995. The company has yet to turn in profits, however, although that situation seems poised to reverse, judging from the trend graphed here.*

Source: David Streitfeld, "Long Amazon.com Tale Still Written in Red Ink", *Los Angeles Times*, July 21, 2001, pp. A1 and 17.

This is reflected well in the market's valuation of Amazon whose stock, which grew from $1.50 a share in 1995 to $113 at the peak of the dot.com bubble, hovered around $16 in June 2001, after having dropped to $8.10 at its 52-week low on April 4, 2001. Thus, the question to examine is whether Amazon.com is a nascent Microsoft, Dell or AOL or one more dot.com dream that has gone awry.

Two valuation strategies particularly commend themselves in this context: (a) the EVA (Economic Value Added) method, and (b) valuation by options.

## 6.3.2 Valuation by the EVA concept:

In essence, valuation based on the EVA (Economic Value Added)[19] concept is an analytical approach. The idea here is that, to add economic value, the firm must receive a greater return on the invested capital than what that capital itself costs. We can therefore define EVA as

$$\textbf{EVA} = (\textbf{ROC} - \textbf{WACC}) \times \textbf{invested capital} \qquad (6.9a)$$

<span style="color:blue">Economic Value Added     return-on-capital     weighted average cost of capital</span>

As Amazon's ROC remains negative as yet, and WACC is a positive number, Equation (6.9a) is not directly applicable to our task at hand, that of valuing Amazon. The alternative approach that we will try, instead, is as follows[20].

– Determine Amazon's current operation value (COV) by assuming that the company is at the stage where it earns the normal operating margin of 10%, and has become profitable, compared to its five-year average operating margin of about –30%.

– The now known COV and the market value (MV) allow us to estimate the future growth value (FGV), using the following relation:

$$\textbf{Market Value (MV)} = \textbf{Current Operation Value (COV)} + \textbf{Future Growth Value (FGV)} \qquad (6.9b)$$

– Examine how practicable and sustainable this future growth value indeed is.

Now, with 359.2 million shares outstanding, Amazon's June 2001 stock price of $16.49 translated into a market value of $5.92 billion. For 2001 sales revenues of $3.2 billion, a 10% operating margin meant a NOPAT (net operating income after taxes) value of $320 million, because Amazon had no tax liability as yet. What would this amount grow to in 10 years? This

requires estimating the discount rate or the cost of the capital that Amazon will need so as to generate these earnings. Amazon has a high beta (= 3.23). Its cost of equity is very high, therefore, and amounts to 23.8% for the numbers we have been using here. Suppose that the cost of debt is 7% and that Amazon settles for the debt/equity ratio = 1. This capital structure is similar to the overall market's long-term debt/asset ratio and implies a 20.4% weighted average cost of capital ($k_{wacc}$) for Amazon. The corresponding estimate of COV = NOPAT/$k_{wacc}$ (= $320 million/0.204) is $1.57 billion, or $4.37 per share. This should also be the price of a Amazon stock if the company stops growing after reaching the point when its operating margin is 10%, instead of the present –30%.

What kind of growth does Amazon need in order to justify its mid-2001 share price of $16.49? We ascertain this by turning to Equation (6.9b). Note that, on subtracting our estimate of COV = $1.57 billion from MV = $5.92 billion, we obtain the future growth value (FGV) of $4.35 billion. Clearly, for our estimate of NOPAT = $320 million to grow to FGV = $4.35 billion in 10 years time, Amazon's revenues will need to grow at about 26% per year. Is this rate sustainable? The graph in Exhibit 6.9 suggests that it is, as does Amazon's performance record. Its 5-year sales growth has been almost 460%. The fact that this is faster than the 381.63% growth in capital spending during this period is certainly a promising sign. But then, Amazon's 5-year average ROA is –58.53%, the corresponding ROI (return-on-investment) and ROE values being –103.9% and –246.02%, respectively. Note that these are measures of management effectiveness.
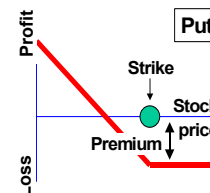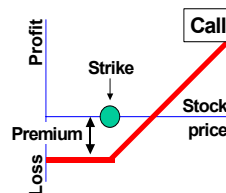
## 6.3.3   Equity Valuation by Call Options

That continued rapid growth in revenue is the key to Amazon's survival is also the message from the options model of equity valuation. As discussed in Chapter 8, an option gives the holder the *right* to trade a stock at a specified strike or exercise price on or before a set expiration date. A call option gives the holder the right to buy, a put option the right to sell. By way of illustration, Exhibit 6.10 shows the July 2001 prices of selected puts and calls on Amazon for January 2002 expiration and different strike prices. These data are for the close of trading on July 20, 2001, when the Amazon shares closed at $16.98. Note that the call option becomes more valuable the more the stock price rises above the options strike price whereas the opposite holds for the put option. With the stock trading at $16.98, for instance, the call option for $5 strike is trading at $12.60 whereas that for $30 strike is trading at $1.15. Here, all the call options with strike prices below the stock price are said to be in the money, as are all the put options whose strike

prices exceed the stock price. Suppose you bought a $5 call option in April 2001, when the stock was trading at about $8.50, and paid $3 for this option. Clearly, your bet was for a rise in the stock's price before your option expired. As this is what has happened, your call option is already worth more than four-times what you had paid for, and you might be well advised to pocket your profits by selling it. What if you had then bought a put option for the same strike price, instead, paying $2 for it. Your bet then was for a further fall in the stock's price. As the opposite has happened since then, and your option is now worth one-quarter of what you had invested, you are better off holding on to it and let it expire worthless if its price does not rise to your level of satisfaction.

***Exhibit 6.10:*** *Tabulated on the left are the July 20, 2001, quotes for selected call and put options on Amazon, with expiration in January 2002. The two cartoons below are the profit-loss diagrams for holders of call and put options. Notice how a call option helps you hedge in a rising market, a put option in a falling market.*

| Calls | Strike Price | Puts |
|---|---|---|
| 12.60 | 5 | 0.50 |
| 10.50 | 7.50 | 0.85 |
| 8.50 | 10 | 1.40 |
| 6.70 | 12.50 | 2.05 |
| 5.60 | 15 | 3.20 |
| 4.20 | 17.50 | 4.50 |
| 3.20 | 20 | 5.80 |
| 1.80 | 25 | 9.60 |
| 1.15 | 30 | 14.00 |

Call — Profit, Strike, Stock price, Premium, Loss

Put — Profit, Strike, Stock price, Premium, Loss

Now that we have your attention, we hasten to add that speculations of this type are not the main reason why the options market thrives[21]. To give an example, suppose you bought Amazon stocks at the April 2001 low of $8.10, then you would have also bought yourself the insurance against fall in the stock's price if you had also bought an adequate amount of put options. Indeed, as we discuss in Chapter 8, call options serve a myriad of purposes. They are bought for leverage, to limit trading risk and/or release cash, to protect the principal and/or short positions, for psychological sustenance, and to fix the security's price for a later-day purchase. Likewise, put options are bought for leverage, to protect long positions and/or book profits, for limited-risk trading and for psychological sustenance. We will return to these fascinating issues in Chapter 8, but must now turn to the reason why we got on to this discussion on options — mainly to explain how we can use options for equity valuation.

As we saw in Exhibit 6.10, the price of an option depends on the price of the underlying security. How the two are related is precisely what the famous Black-Scholes formula[22] is all about. It gives the value of a call option as

$$\text{Value of the call option} \quad = \quad N(d_1) \times S \quad - \quad N(d_2) \times e^{-rT} X \qquad (6.10)$$

<center>↑        ↑           ↑</center>

<center>option's delta    share price    PV of a bank loan</center>

Here,      $X$ = the option's strike price

           $S$ = the price of the underlying security

         $N(d)$ = cumulative normal probability density function[23], with

$$d_1 = \frac{\ln(S/X) + rT}{\sigma \sqrt{T}} + \tfrac{1}{2} \sigma \sqrt{T}$$

$$d_2 = d_1 - \sigma \sqrt{T}$$

           $T$ = the option's time to maturity,

And          $\sigma$ = the volatility of the asset price

We can use Equation (6.10), and value Amazon.com and its equity as a call option, by noting that while Amazon's equity is actually a deficit as yet, *sensu stricto*, the most that the equity investors in this or any other publicly traded firm can lose is their investment. This is because of the principle of limited exposure, and the reason why this issue arises here is that we are going to value Amazon's assets and debts and apply the residual to the equity. After all, much like a call option where the payoff exists only when the stock price (S) exceeds the strike price (X), the equity-holders receive only the residual from the firm's liquidation-proceeds (V) that remains after meeting the demands of other financial claim-holders (D). This makes it reasonable to use the value of the call option as the proxy for the value of the firm.

In terms of Equation (6.10), we therefore set, for Amazon.com

| | | |
|---|---|---|
| $S$ = | value of the underlying asset | = \$3.2 bill in 2001 (\$4.0 bill in 2002) |
| $X$ = | face value of outstanding debt | = \$2.2 bill in 2001 (\$2.5 bill in 2002) |
| $T$ = | life of the option   =   duration of Amazon's debt | =   5 years, say |
| $r$ = | risk-free rate   = Treasury bond corresponding to option-life = | 5% |
| $\sigma$ = | volatility of underlying asset | = St. Dev. of Amazon stock price |

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To compute the last of these numbers, note that Amazon's year 2000 asset/debt ratio ($2.25 billion/$2.08 billion) is about the same as the above projections for 2001 and 2002. Computing $\sigma$ for an asset/debt ratio of 1.2 would be a reasonable generalization, therefore. With $\sigma_{debt} = 0.12$, the annualized volatility of returns on Amazon's stock price $\sigma_{amazon} = 0.95$, and the correlation of their changes $\rho_{amazon\text{-}debt} = 0.25$, the volatility of Amazon's assets works out[24] to $\sigma = 0.54$, so that the other numbers that we need are

| | | | | | |
|---|---|---|---|---|---|
| $d_1$ | = | 0.9874 | $d_2$ | = | $-0.22$ |
| $N(d_1)$ | = | 0.8383 | $N(d_2)$ | = | 0.4129 |

Thus,

| | | |
|---|---|---|
| **the value of the call** | **=** | **$0.8383 \times \$3.2$ billion** |
| **option on Amazon** | | **$- 0.4129 \times 0.7047 \times \$2.2$ billion** |
| | **=** | **$2.04 billion** |

For 359.2 million shares outstanding, this firm value implies a per share price of $5.69 which, though superior to the $4.37 share value that we derived earlier using the EVA concept, is still a far cry from the current share price of about $16. What if we incorporate growth by looking at our above projections for the year 2002? In that case the firm valuation works out to $2.63 billion which, for the same number of stocks outstanding as now, means a price of $7.31 per share. This is certainly an impressive return, with 28.5% price-appreciation in one year, but still suggests that Amazon shares will remain overvalued for several years even if the present price does not change. Indeed, even if we ignore the debt-term here altogether by assuming that $T \to \infty$ in Equation (6.10), we obtain a price of $9.34 for Amazon's shares. Mathematically, though, this is a monstrosity because the $N(d_1)$ term in Equation (6.10) is indeterminate if T is set at $\infty$!

The use of real options for managerial decision making has proven to be a major improvement over the conventional NPV (net present value) analysis[25]. High growth companies have numerous options for growth, for instance, all of which add to the present value of a firm even though they are not necessarily amenable to valuation by the traditional methods. However inadvertently, though, this method unfortunately got used more for rationalizing[26] the hypervaluation of internet stocks during the bull market's extraordinary run-up in the late 1990s, than for predicting the prices.

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What do the traditional valuation models say about Amazon's price? The company's negative earnings and shareholders' deficit rather than equity leave us with price-to-sales ratio as the only multiple that we can use here. The problem is that Amazon.com is a business that has neither a peer nor a history. If we treat it as a bookseller then, for the $69 per share of sales that Barnes & Noble generated for its July 2001 share price of $36.28, we should price Amazon's shares at almost one-eight as much. But a brick-and-mortar business like Barnes & Noble has to invest far more than Amazon to generate the same revenue run rate[27]. What if we treat Amazon as the prospective Wal-Mart of the web? With almost $200 billion in sales, and 4.5 billion shares outstanding, Wal-Mart has five times as much in sales-revenues per share as Amazon does. Thus, valued relative to Wal-Mart's July 2001 share price of $53.10, Amazon's shares should be priced at about $10.

We could also use the price-to-cash flow multiple here, of course. But Amazon's difficult cash flow situation suggests that rather than using the cash flow data for a single year or an average as in the method of multiples, we perform the cash flow analysis in its entirety. This is shown in Exhibit 6.11. Several simplifying assumptions have been made here[28]. We have used a two-stage growth model. We start with a growth rate of 20% in 2002, lower it by 10% each year until 2009, and then keep it fixed at 5% from 2010 in perpetuity. The operating margin, estimated at –7% in 2001, is assumed to turn positive in 2005, exactly a decade after the company started operating.

As Amazon is a "virtual" as opposed to a brick-and-mortar business, depreciation and amortization numbers are unlikely to be significant and are therefore ignored here. We have assumed a 20% cost of equity during 2001-2010 and 10% thereafter. Finally, if we take $\Sigma FCFF = \Sigma FCFE$ by ignoring debt and the cost of employee options, then we obtain a $16.25 share price. But each $1 billion in present value of this burden knocks $2.75 off the share price. As uncertainties are ubiquitous in these computations, a slight tweaking of the estimated growth-rates can easily solve this problem, if these costs are not factored into the operating margin. Just raise the growth rate, by lowering the 2002 estimated growth rate of 20% by 6%, and not 10%, each year until 2009. Then $\Sigma FCFF = \$6.81$ billion while $\Sigma FCFE$ would remain effectively unchanged if the debt burden is about $1 billion, to support a $16.25 share price. Otherwise, for $2.2 billion as the present value of this burden, $\Sigma FCFE_{2001} = \$3.65$ billion which implies a $10.14 share price.

Both these possibilities, either factoring these costs into operating margins or assuming higher revenue growth rates, are realistic. Actually, the growth rates we have assumed here may turn out to be excessively cautious.

What is not clear is whether Amazon can sustain[29] the cash flow that it needs in order to have these operating margins and generate these revenues.

*Exhibit 6.11:*    *The valuation of Amazon.com by Free cash flow analysis.*

| | Operating Margin | Revenue growth, % | Revenue (bill $) | EBIT(1-Tax) (mill $) | PV (mill $) |
|---|---|---|---|---|---|
| 1995* | -6% | ... | ... | ... | ... |
| 1996* | -10% | 19,500 | 0.1 | -10 | ... |
| 1997* | -35% | 100 | 0.2 | -70 | ... |
| 1998* | -33% | 200 | 0.6 | -200 | ... |
| 1999* | -47% | 185 | 1.7 | -800 | ... |
| 2000* | -54% | 53 | 2.6 | -1400 | ... |
| 2001* | -7% | 31 | 3.4 | -234 | -234 |
| 2002* | -5% | 20 | 4.1 | -204 | -170 |
| 2003+ | -3% | 18 | 4.8 | -144 | -100 |
| 2004# | -1% | 16 | 5.6 | -56 | -32 |
| 2005# | 1% | 15 | 6.4 | 42 | 20 |
| 2006# | 3% | 13 | 7.3 | 141 | 57 |
| 2007# | 5% | 12 | 8.1 | 263 | 88 |
| 2008# | 7% | 11 | 9.0 | 408 | 114 |
| 2009# | 9% | 10 | 9.8 | 575 | 134 |
| 2010# | 10% | 5 | 10.3 | 671 | 284 |

*Tax rate = 0%, +Tax rate = 15%,
#Tax rate = 35%

**For the data given here,**

$\Sigma PV_{2001\text{-}2010} = \$0.16$ billion

$\Sigma PV_{2010 \to \infty} = \$5.69$ billion

Present value of free cash flow to the firm ($\Sigma$FCFF)

$= \$5.85$ billion

$\therefore \Sigma$FCFE $= \$(5.85\text{-}2.20)$ billion

$= \$3.65$ billion

Number of shares = 360 million

$\therefore$ **Share price = \$11.14**

But, if $\Sigma$FCFE = $\Sigma$FCFF, then share price = \$16.25

Adapted from Aswath Damodaran's excel worksheet

Overall, Amazon.com is a good company, with an innovative, conceptually powerful and seductively simple business plan. Its revenue growth has been impressive (its sales grew 16% in the 2001 second quarter, for instance, with an 18% drop in the marketing costs) and it is already a gorilla in its market segment, the B2C segment of e-business (Exhibit 6.12).

*Exhibit 6.12*

*The business-customer matrix in e-business. Here, Amazon is a pioneer and already a leader in the B2C sector.*



|  | Business | Consumer |
|---|---|---|
| Business | B2B | B2C |
| Consumer | B2C | C2C |

As shown in Exhibit 6.12, internet based businesses can be broadly grouped, therefore, as B2B (business-to-business: e.g., I-2 Technologies), B2C (business-to-consumer: e.g., amazon.com, priceline.com), and C2C (consumer-to-consumer: e.g., e-Bay). This reflects the fact that, in terms of business applications, internet is only a facilitator, and not an end in itself.

The entire e-business sector of the market is still in its infancy, however. These dismal valuations seem more likely, therefore, to capture the angst of growth than predict the future of Amazon.com and the like businesses. It is still too soon to tell what kind of future a "virtual" business with no brick-and-mortar presence and based on pure internet-play can indeed have. Internet empowers the individual, in the main. Perhaps some indications of what lies ahead are already implicit in the continuing high valuations of a C2C e-business like e-Bay vis-à-vis the problems that plague a B2B gorilla like I2 Technologies (NASDAQ: ITWO) and B2C businesses like Amazon.com and Priceline.com (NASDAQ: PCLN). For the B2B and B2C sectors, perhaps the internet can be no more than just another business tool, and not the basis for a stand-alone operation. If this is true then it is quite likely that, instead of surviving independently, Amazon will be gobbled by AOL-Time Warner or a like company with a formidable presence on the web, i.e., if AOL can first resolve its ongoing problems!

## 6.4 Putting it all together, analytically

### 6.4.1 Four Questions

This chapter and the preceding chapter has focused on the lessons from financial economics as they apply to investment decisions. We have seen that success in financial investments is hardly a matter of luck alone. Reasoned judgement also matters[30], perhaps a great deal more, particularly as we now possess an incredible array of quantitative tools and empirical wisdom to aid that judgement. Nonetheless, there are quite a few areas where much work remains to be done although, in the final analysis, it often boils down to what you basically believe in. Take the case of equity and firm valuations discussed in this chapter, for instance. We faced few uncertainties in the valuation of established firms in relatively mature industries and had, as a matter of fact, an impressive array of strategies whose results are comparable. But seeking to evaluate an upcoming firm in a growing sector of the economy, where investing is likely to offer the best prospects for gain, turns valuation almost into an art!

A savvy investor may well ask, therefore, as to *where do we go from here*. This deceptively simple question raises the following issues:

-   How about the market's valuation itself? The issue to be examined is whether "correct" valuation is in fact possible.

-   How reliable is a valuation indicator such as the P/E ratio in terms of future stock market performance?

-   What implications do all of these have in terms of market efficiency and the development of a profitable investment strategy?

-   How does global diversification influence the above results?

### 6.4.2 From valuation to performance

Three issues need to be tackled before we can proceed any further in these discussions. First, many readers may either not have the patience to perform the valuation analyses themselves or may find it to be too dauntingly cumbersome an exercise to be left to the lay person. Second, we need to know how reliably such valuations can help us distinguish the overvalued equities from the undervalued ones. And three, how good a guide to the future it can be, i.e., do the undervalued equities indeed overperform the overvalued ones or are they undervalued for good reasons?

The first of these need not pose a problem, however, thanks to the miscellany of excellent sites on the Internet. By way of illustration, Exhibit 6.13 reproduces ValuePro's cash flow analysis of Microsoft Corporation that can be freely accessed at the site www.valuepro.net where you will find intrinsic valuation as well as cash flow analysis. This also updates the cash flow based valuation of Microsoft in Exhibit 6.8. The difference between the two estimates, $77.10 in Exhibit 6.8 versus $54.17 in Exhibit 6.13 is quite substantial. But times have changed too, rather drastically. ValuePro's DCF valuation of Microsoft Corporation shares in July 2001 was $65.37, for instance, compared to the appraisals at $47.24 and $38.65, respectively, by Quicken (www.quicken.com) and Morningstar (www.morningstar.com). Our estimates in Exhibit 6.3 ranged from $53.16 to $78.93!

The valuation techniques used by ValuePro, Quicken and Morningstar are different, and many other equally reputed web-sites use still different techniques. For instance, the valuation at ValuePro is based on discounted free-cash flow analysis whereas the intrinsic valuation at Quicken is *"a hypothetical value that is based on the sum of a company's future earnings"*. The complete valuation at Quicken also includes (a) growth trends, (b) financial health, (c) management performance, and (d) market multiples. Morningstar, on the other hand, emphasizes not only the business prospects of the particular firm but also those of the sector, the industry, and the economy at large.

For an investor seeking less uncertainty, therefore, an effective strategy would be to start with the 'no-growth' valuation from cash flow analysis, as if the company has already reached the stable phase. To this estimate, e.g., the share value of $51.40 for Microsoft in Exhibit 6.8, we can then add or subtract appropriate amounts for the different attributes.

Take Microsoft's brand value, for instance. Brands, as a matter of fact, expose a major limitation of the established valuation strategies. Valuations based on cash flows and ratios alone miss out on the value of intangible assets like brands. Not being an unknown entity, the name 'Microsoft' itself must surely be worth something. Why would businesses spend billions of dollars in advertising their names and services if a recognizable name carried no value? Microsoft's brand value itself is now estimated at $64.1 billion (Exhibit 6.14). We should therefore add $11.87 per share (i.e., $64.1 billion ÷5.4 billion shares) to our valuations of $51.40 (Exhibit 6.8) to $78.93 (Exhibit 6.3) for the Microsoft shares if we are to price them fairly.

*Exhibit 6.13: Valuation of Microsoft by Cash Flow Analysis at the site www.valuepro.net*

| Period | Revenues | NOP | Adj. Taxes | NOPAT | Invest. | Depre-ciation | Change in Invest. | Change in Working Capital | FCFF | Discount Factor | Discounted FCFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $31,201.50 | $18,552.41 | $6,215.06 | $12,337.35 | $1,360.39 | $1,893.93 | -$533.54 | $278.54 | $12,592.35 | 0.92 | $11,584.96 |
| 2 | $34,321.65 | $20,407.65 | $6,836.56 | $13,571.09 | $1,496.42 | $2,083.32 | -$586.90 | $306.40 | $13,851.59 | 0.84 | $11,635.34 |
| 3 | $37,753.82 | $22,448.42 | $7,520.22 | $14,928.20 | $1,646.07 | $2,291.66 | -$645.59 | $337.04 | $15,236.75 | 0.77 | $11,732.30 |
| 4 | $41,529.20 | $24,693.26 | $8,272.24 | $16,421.02 | $1,810.67 | $2,520.82 | -$710.15 | $370.74 | $16,760.43 | 0.71 | $11,899.91 |
| 5 | $45,682.12 | $27,162.59 | $9,099.47 | $18,063.12 | $1,991.74 | $2,772.90 | -$781.16 | $407.82 | $18,436.46 | 0.65 | $11,983.70 |
| 6 | $50,250.33 | $29,878.85 | $10,009.41 | $19,869.44 | $2,190.91 | $3,050.20 | -$859.29 | $448.60 | $20,280.13 | 0.60 | $12,168.08 |
| 7 | $55,275.36 | $32,866.73 | $11,010.35 | $21,856.38 | $2,410.01 | $3,355.21 | -$945.20 | $493.46 | $22,308.12 | 0.55 | $12,269.47 |
| 8 | $60,802.90 | $36,153.40 | $12,111.39 | $24,042.01 | $2,651.01 | $3,690.74 | -$1,039.73 | $542.80 | $24,538.94 | 0.50 | $12,269.47 |
| 9 | $66,883.19 | $39,768.74 | $13,322.53 | $26,446.21 | $2,916.11 | $4,059.81 | -$1,143.70 | $597.08 | $26,992.83 | 0.46 | $12,416.70 |
| 10 | $73,571.50 | $43,745.61 | $14,654.78 | $29,090.83 | $3,207.72 | $4,465.79 | -$1,258.07 | $656.79 | $29,692.11 | 0.42 | $12,470.69 |

Note: These figures are in million $

| | | | | | |
|---|---|---|---|---|---|
| Discounted Excess Return Period FCFF = | $120.43 | billion | Total Corporate Value = | $304.96 | billion |
| Discounted Corporate Residual Value = | $136.71 | billion | Less Debt = | $0.00 | |
| Short-Term Assets = | $47.83 | billion | Less Preferred Stock = | $0.00 | |
| Total Corporate Value = | $304.96 | billion | Less Short-Term Liabilities = | $11.64 | billion |
| | | | Total Value to Common Equity = | $293.32 | billion |
| Number of shares outstanding = | 5.42 | billion | Intrinsic Stock Value = | $54.17 | |

(slightly modified from the ValuePro 2002 General Pro Forma Screen for MSFT at the URL: www.valuepro.net/cgi-v/valuate.pl)

*Exhibit 6.14*

| | Brand Value (billion $) | | |
|---|---|---|---|
| | 2002 | 2001 | 2000 |
| Coca-Cola | 69.64 | 68.95 | 72.54 |
| Microsoft | 64.09 | 65.07 | 70.20 |
| IBM | 51.19 | 52.75 | 53.18 |
| GE | 41.31 | 42.40 | 38.13 |
| Intel | 30.86 | 34.67 | 39.05 |
| Nokia | 29.97 | 35.04 | 38.53 |
| Disney | 29.26 | 32.59 | 33.55 |
| McDonald's | 26.38 | 25.29 | 27.86 |
| Marlboro | 24.15 | 22.05 | 21.20 |
| Mercedes | 21.01 | 21.73 | 20.00 |

The effect of incorporating the brand value is particularly dramatic on the valuation numbers of a company like Amazon. Recall that our exercises in the preceding section priced its shares at $4.37 to $10. But this did not include any price tag for the name Amazon.com itself. In the case of Amazon, therefore, our valuation should include its 2002 brand value of $3.2 billion, based on the data in Business Week magazine referenced above. For about 360 million shares outstanding, this amounts to a hefty $8.89 a share. Brand value is fickle and this valuation verges on the arbitrary. Be ready, therefore, for large year-to-year swings.

This brings us to the other two issues that were raised earlier in this section, viz., what information to glean from valuation and what purpose gets served in the process. Exhibit 6.15 should help us tackle both these questions. It compares the mid-year 2001 and mid-year 2002 price and valuation data for the 30 Dow components. The data summarized in this Exhibit come from ValuePro (www.valuepro.net), Quicken (www.quicken.com), Morningstar (www.morningstar.com) and Yahoo Finance (finance.yahoo.com) websites, while the last four columns in this Exhibit compare how well these measures have performed over the past one-year period. This is not to evaluate the excellent public service being performed by these sites, however, but only to maximize our use of the data that they are providing so generously.

**Exhibit 6.15:** *A comparison of the performance of selected valuation strategies for the valuation of Dow companies*

| Company | Ticker Symbol | Mid-year 2002 data | | | | | Mid-year 2001 data | | | | Valuation as a performance indicator | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Price on Aug 21, 2002 | Intrinsic Valuation | | 12-month target at Yahoo Finance | | Price on July 31, 2001 | Intrinsic Valuation | | Morningstar Business Appraisal | 1-year price change | valupro | quicken | morning-star |
| | | | at Valuepro | at Quicken | Range | Mean | | at Valuepro | at Quicken | | | | | |
| Aluminum Co. of America | AA | $26.87 | $37.01 | $9.67 | $35-$53 | $42.73 | $39.06 | $84.32 | $36.30 | $40.63 | -31.21% | -53.68% | 7.60% | -3.86% |
| American Express | AXP | $37.34 | $55.45 | $21.38 | $33-$46 | $36.90 | $38.06 | $8.00 | $37.62 | $48.58 | -1.89% | 375.75% | 1.17% | -21.66% |
| AT & T | T | $12.22 | -$32.10 | - | $10-$23 | $14.95 | $20.05 | - | - | $14.27 | -39.05% | - | - | 40.50% |
| Boeing | BA | $37.13 | $101.94 | $51.90 | $40-$80 | $52.67 | $56.67 | $213.43 | $99.21 | $71.80 | -34.48% | -73.45% | -42.88% | -21.07% |
| Caterpillar | CAT | $44.85 | $28.30 | $3.19 | $45-$66 | $55.47 | $53.00 | $32.43 | $28.63 | $52.95 | -15.38% | 63.43% | 85.12% | 0.09% |
| Citigroup | C | $34.00 | $83.94 | $55.35 | $42-$60 | $50.61 | $49.35 | $105.12 | $55.37 | $65.75 | -31.10% | -53.05% | -10.87% | -24.94% |
| Coca Cola | KO | $52.70 | $43.83 | $34.04 | $51-$70 | $61.40 | $44.98 | $36.01 | $29.88 | $35.95 | 17.16% | 24.91% | 50.54% | 25.12% |
| Disney | DIS | $16.83 | $18.96 | $4.29 | $14-$28 | $21.28 | $26.47 | $8.29 | - | $17.88 | -36.42% | 219.30% | - | 48.04% |
| DuPont | DD | $41.12 | $22.44 | $99.23 | $34-$57 | $47.00 | $43.21 | $37.52 | $13.95 | $36.94 | -4.84% | 15.17% | 209.75% | 16.97% |
| Eastman Kodak | EK | $31.48 | $20.28 | $6.90 | $27-$40 | $32.00 | $44.14 | $63.81 | $41.84 | $61.73 | -28.68% | -30.83% | 5.50% | -28.50% |
| ExxonMobil | XOM | $36.15 | $43.19 | $41.52 | $30-$50 | $40.14 | $42.13 | $68.69 | $48.12 | $33.92 | -14.19% | -38.67% | -12.45% | 24.20% |
| General Electric | GE | $32.25 | $39.66 | $23.85 | $36-$50 | $40.79 | $43.80 | $45.91 | $34.87 | $36.41 | -26.37% | -4.60% | 25.61% | 20.30% |
| General Motors | GM | $47.92 | -$121.69 | $0.00 | $45-$84 | $64.18 | $62.95 | $150.31 | - | $59.98 | -23.88% | -58.29% | - | 4.95% |
| Hewlett-Packard Co. | HPQ | $14.70 | $21.53 | $4.69 | $18-$32 | $22.08 | $25.68 | $37.49 | $26.68 | $22.61 | -42.76% | -31.50% | -3.75% | 13.58% |
| Home Depot | HD | $33.53 | $30.16 | $53.85 | $31-$65 | $44.33 | $49.21 | $20.07 | $50.56 | $38.96 | -31.86% | 145.19% | -2.67% | 26.31% |
| Honeywell | HON | $30.35 | $36.34 | $12.85 | $33-$50 | $42.50 | $36.80 | $58.33 | $15.24 | $40.11 | -17.53% | -36.91% | 141.47% | -8.25% |
| Intel | INTC | $17.96 | $6.34 | $9.53 | $18-$40 | $28.00 | $29.42 | $27.09 | $30.34 | $14.69 | -38.95% | 8.60% | -3.03% | 100.27% |
| International Bus. Machines | IBM | $80.40 | $85.66 | $61.28 | $70-$120 | $94.46 | $104.89 | $120.14 | $107.15 | $108.65 | -23.35% | -12.69% | -2.11% | -3.46% |
| International Paper | IP | $37.91 | $10.85 | - | $31-$62 | $48.43 | $39.21 | $87.92 | - | $29.62 | -3.32% | -55.40% | - | 32.38% |
| Johnson & Johnson | JNJ | $54.82 | $75.77 | $52.13 | $46-$75 | $61.67 | $52.70 | $60.26 | $45.76 | $51.67 | 4.02% | -12.55% | 15.17% | 1.99% |
| McDonalds | MCD | $23.97 | $21.96 | $17.38 | $26-$40 | $32.00 | $29.30 | $27.54 | $24.83 | $27.69 | -18.19% | 6.39% | 18.00% | 5.81% |
| Merck | MRK | $50.43 | $69.04 | $56.41 | $36-$72 | $53.18 | $64.99 | $77.85 | $65.24 | $68.24 | -22.40% | -16.52% | -0.38% | -4.76% |
| Microsoft | MSFT | $52.22 | $54.17 | $41.57 | $45-$89 | $66.29 | $67.48 | $65.37 | $47.24 | $38.65 | -22.61% | 3.23% | 42.85% | 74.59% |
| Minnesota Metals & Manuf. | MMM | $126.95 | $85.93 | $85.03 | $100-$160 | $131.56 | $110.36 | $103.70 | $85.68 | $94.36 | 15.03% | 6.42% | 28.80% | 16.96% |
| JP Morgan | JPM | $24.60 | -$31.97 | $0.28 | $27½-$45 | $36.82 | $150.62 | $335.32 | $42.91 | $56.14 | -83.67% | -55.08% | 251.01% | 168.29% |
| Phillip Morris | MO | $50.95 | $107.38 | $85.73 | $43-$70 | $59.43 | $44.68 | $114.18 | $88.12 | $75.68 | 14.03% | -60.87% | -49.30% | -40.96% |
| Proctor & Gamble | PG | $89.96 | $76.80 | $59.21 | $88-$110 | $97.89 | $70.00 | $63.37 | $51.62 | $59.34 | 28.51% | 10.46% | 35.61% | 17.96% |
| SBC Comm. | SBC | $29.24 | $37.32 | $26.39 | $25-$65 | $34.66 | $43.38 | $53.05 | $45.74 | $42.13 | -32.60% | -18.23% | -5.16% | 2.97% |
| United Technologies | UTX | $61.30 | $121.04 | $99.26 | $60-$90 | $75.13 | $73.77 | $114.77 | $102.46 | $92.68 | -16.90% | -35.72% | -28.00% | -20.40% |
| WalMart | WMT | $54.39 | $30.05 | $38.27 | $49-$70 | $62.35 | $55.10 | $30.23 | $36.00 | $39.47 | -1.29% | 82.27% | 53.06% | 39.60% |

Note: These valuation data have been taken from the web-sites of ValuePro (www.valuepro.net), Quicken (www.quicken.com), Yahoo (www.yahoo.com) and Morningstar's (www.morningstar.com). In the last three columns, negative numbers imply the identification that a stock price is undervalued.

The last three columns in this Exhibit use these numbers to identify the companies that were overvalued in mid-year 2001, and the ones that were undervalued, by comparing these valuation data with the July 31, 2001, closing prices. They have been computed as the percentage points by which these prices were above or below the corresponding valuation numbers. Thus, the positive numbers here denote overvalued or over-priced companies and negative numbers the undervalued or under-priced ones. On regressing these valuation numbers against the corresponding prices, we find that valuation based mainly on cash flow analysis (i.e., the ValuePro data) correlated best (correlation coefficient $R = 0.74$), and intrinsic value estimates (i.e., the Quicken data) the least ($R = 0.48$), with the then current prices. These statistics are summarized in Exhibit 6.16 below.

*Exhibit 6.16:*

*Correlation matrixes for valuation (left panel) and relative valuation or undervalued versus overvalued (right panel) data of Exhibit 3.54 corroborate the fact that there are no cut-and-dried measures to identify overvalued vis-à-vis undervalued stocks. The 2002 data are shown in parentheses, and for 2001 data outside them.*

| | Prices | ValuePro | Quicken | ValuePro | Quicken |
|---|---|---|---|---|---|
| ValuePro | 0.74 (0.45) | | | | |
| Quicken | 0.48 (0.61) | 0.47 (0.68) | | -0.02 (-0.50) | |
| MorningStar | 0.67 ( - ) | 0.48 ( - ) | 0.87 ( - ) | 0.01 ( - ) | 0.57 ( - ) |

With a sampling that is at once thoroughly biased and yet most representative, comprising perhaps the world's most watched and best analyzed companies, finding broad agreements between the prices of these equities and their valuations by different methods is hardly a surprising result. It only suggests that these prices were broadly consistent with cash flow and business prospects. But the correlation data in Exhibit 6.16 also reveal poor agreements between the results of different valuation methods. Quicken and Morningstar valuations match each other better, and poorly with the DCF valuations (ValuePro). The ValuePro and Quicken valuations correlate better for the 2002 prices, and the Quicken valuations seem to like the 2002 market prices better than the 2001 prices. Curiously, this improved agreement has had the opposite effect on relative valuation or the identification of whether a certain company is overvalued or undervalued. The correlation coefficient for relative valuations from ValuePro and Quicken numbers, almost zero for 2001 prices, actually became –0.5 in 2002!

In terms of our issue number two, viz., what information an investor can glean from a valuation exercise, the data in the last three columns of

Exhibit 6.15 illustrate how undervalued firms can be distinguished from the overvalued ones. But they also show that this identification is hardly categorical — just because one method identifies any equity as overpriced or underpriced does not mean that other methods would do the same.

This brings us to issue number three, viz., to see what investment advantage does this information offer. Common sense tells us that we stand to gain the most by buying low and selling high. Helping an investor in selecting undervalued and properly valued stocks should thus be the obvious and most immediate advantage of a valuation exercise. The question, then, is whether today's overpriced stock is going to be tomorrow's overperformer or that its days of superior performance are behind it. Let us start with the premise that, on comparing future price performance against current valuation, we would expect overpriced stocks to underperform the underpriced ones. True, the past year (2001) has continued to be bad for the market at large, the Dow itself having lost 20.4% in value and 15.4% in total returns. But then, one year is often the most we have to reevaluate the investment strategy and portfolio. Exhibit 6.17 thus summarizes the correlation coefficients for price performance and relative valuation data of Exhibit 6.15, to help us evaluate the performance of our Dow valuations.

| | Price Changes | ValuePro | Quicken |
|---|---|---|---|
| ValuePro | 0.14 | | |
| Quicken | -0.22 | -0.02 | |
| MorningStar | -0.47 | 0.01 | 0.57 |

*Exhibit 6.17:*

*The correlation matrix for 1-year price changes and Dow valuations in Exhibit 6.15.*

Here, the correlation between performance and cash flow (R = 0.14) and intrinsic valuation (-0.22) models is poor. Perhaps this is because prices have generally moved in the same direction, downwards (e.g., 25 of these 30 have fallen), though in varying degrees. This is not a surprising result, therefore. Business valuation data (i.e., relative valuations from Morningstar data) show a stronger negative correlation (R = -0.47) of performance and overvaluation, however, and have thus been the best of the three valuations in indicating future price movements. Since business appraisal looks at managerial efficiency as also the broad market and macroeconomic factors, and not only the cash flow, this emphasizes the investor's need to also scan a company's survival and growth prospects.

Two inferences can be drawn from this appraisal: (a) cash flow is a reasonably reliable basis for valuation, at least for the large cap companies examined here, and (b) business appraisal provides a reasonable gauge of future price performance. Though important, valuation forms only a part of

the arsenal that successful investing requires. The Warren Buffett way[31], for instance, is to focus not only on the financial factors but also on managerial efficiency and effectiveness. The questions in Exhibit 6.18, culled from the Quicken web-site, illustrate this.

*Exhibit 6.18:*

*Successful investors focus on managerial efficiency and effectiveness as the keys to a stock's market performance.*

**The Warren Buffett Way strategy asks these questions**

❶ Has the company performed well consistently?
❷ Has the company avoided excess debt?
❸ Can managers convert sales to profits?
❹ Are managers handling shareholders' money rationally?
❺ Has management actually increased shareholder value?
❻ Has the company consistently increased owner earnings?
❼ Is the stock selling at a 25% discount to intrinsic value?

Source: http://www.quicken.com

The concept of EVA (economic-value-added) presented in Equation (6.9a) provides a possible way to quantify this, together with the concept of sustainable growth rate given in Equation (6.7b). The *financial strategy matrix* of Hawawini and Viallet[32] (Exhibit 6.19) illustrates this integration and can be also used as an investing tool. The horizontal axis here measures a firm's capacity to finance growth, and is the amount by which its sustainable growth rate (g) exceeds the growth rate for revenues ($G_{rev}$), i.e.,

$$\text{Firm's capacity to finance growth} = \text{sustainable growth rate (g)} - \text{growth in revenues } (G_{rev}) \qquad (6.11a)$$
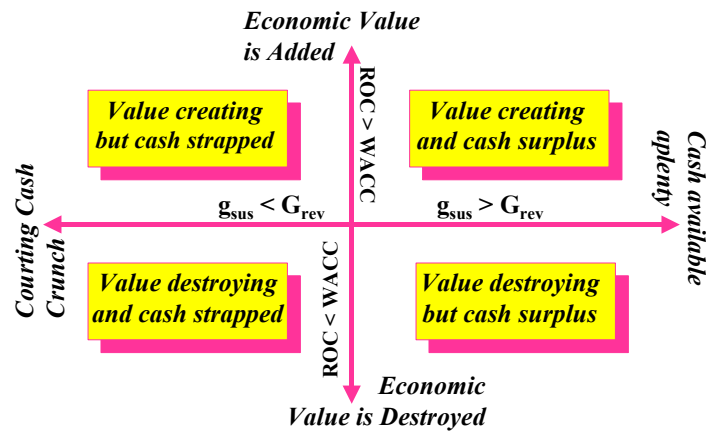
Note that Equation (6.7b) was an approximation for sustainable growth rate (g), its complete form being as follows[33]:

$$\text{Firm's sustainable growth in sales (g)} = \frac{\text{return-on-equity} \times \text{retained earnings}}{1 - \text{return-on-equity} \times \text{retained earnings}} \qquad (6.11b)$$

This number denotes the maximum growth in revenues that a firm can sustain without having to change its operating (i.e., operating profit margin and capital turnover) and/or financing (i.e., the debt-to-equity and dividend-payout ratios) policies.

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**Exhibit 6.19**

*The financial strategy matrix of Hawawini and Viallet.*

*Economic Value is Added* ↑  $ROC > WACC$

**Courting Cash Crunch** ← | → **Cash available aplenty**

| | |
|---|---|
| **Value creating but cash strapped** | **Value creating and cash surplus** |
| $g_{sus} < G_{rev}$ | $g_{sus} > G_{rev}$ |
| **Value destroying and cash strapped** | **Value destroying but cash surplus** |

$ROC < WACC$ ↓ *Economic Value is Destroyed*

The vertical axis here is the firm's ability to add economic value. It basically denotes the operating profit generated by the firm's net assets and net of the taxes and the dollar cost of capital that financed these assets. As given in Equation (6.9a), it is computed as

$$\text{Economic Value Added} = \left[ \text{return on capital} - \text{weighted average cost of capital} \right] \times \text{invested capital} \quad (6.11c)$$
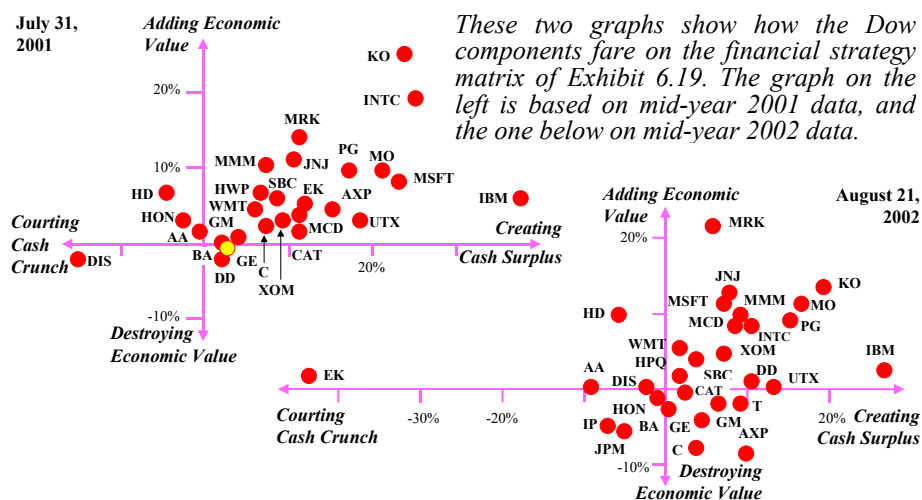
Here, $\text{return on capital (ROC)} = \text{Operating profit margin} \times \text{net asset turnover}$

and $\text{weighted average cost of capital (WACC)} = \text{The aftertax cost of debt} \times \text{\% debt financed} + \text{Cost of equity} \times \text{\% equity financed}$

The truth here is obvious: *economic value is added only if returns on invested capital exceed the costs incurred in generating that capital*.

Based on their financial strategy mix, the firms can be thus placed in one of these four quadrants in Exhibit 6.19. The ideal position is that of a *cash-rich* (g > $G_{rev}$) *value-creator* (ROC > WACC) (i.e., top right corner in the Exhibit), whereas the *cash-strapped* (g < $G_{rev}$) *value-usurper* (ROC < WACC) (i.e., bottom left corner here) is the worst placed here. The other two — the *cash-strapped* (g < $G_{rev}$) *value-creator* (ROC > WACC) (top left) and the *cash-rich* (g > $G_{rev}$) *value-usurper* (ROC < WACC) (bottom right) — occupy intermediate positions between the two extremes.

How do our blue chip Dow components fare on this matrix? Exhibit 6.20 provides the answer. Note that all these companies are amongst America's best-known and most successful companies. Not surprisingly, therefore, they are mostly value-creators. In terms of their cash availability for growth, though, there is a wide scatter. At one extreme, we have the cash surplus companies like Coca-Cola and IBM, for instance, whereas, at the other extreme, we had the cash-deficit companies like Disney, Home Depot and Honeywell in 2001 and Eastman Kodak at the pack of a larger list in 2002. Perhaps we can now understand why a stock-picking genius like Warren Buffet would rather own Coca-Cola than Microsoft!

### Exhibit 6.20



*These two graphs show how the Dow components fare on the financial strategy matrix of Exhibit 6.19. The graph on the left is based on mid-year 2001 data, and the one below on mid-year 2002 data.*

How well does this matrix predict future returns? To test this the same way as we tested the performance of the other models in Exhibit 6.17, we ran a multiple regression analysis of the two 2001 variables in Exhibit 6.19 against the 1-year price changes shown in Exhibit 6.15. That initial regression carried a multiple R = 0.51 which improved to 0.53 when we regressed price changes against the ratios $G = G_{rev}/g$ and $R_{cost} = ROC/WACC$ as independent variables, instead of the differences given by Equations (6.11a) and (6.11c). The improvement was dramatic when we added one of the sets of valuation numbers in Exhibit 6.15 as an independent variable. The resulting regression equation, given below for Morningstar numbers, has a multiple R of 0.722 (the returns here are relative to the Dow index):

| 2001-02 return relative to Dow index | = | $-0.078 + 0.107\ R_{cost}$ $-0.054\ G - 0.265\ V_{morningstar}$ | (6.11d) |
|---|---|---|---|

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Here $G = (G_{rev}/g)$ and $R_{cost} = (ROC/WACC)$, as stated above, while $V_{morningstar}$ denotes the Morningstar relative valuation in the last column in Exhibit 6.15.

Exhibit 6.21 graphs the observed price changes against the corresponding values computed from Equation (6.11d). Notice how well the two sets of data match. Valuation numbers alone clearly provide an insufficient gauge of the returns that the investors care about. Based on Equation (6.11d), they need to be augmented with the cost ($R_{cost}$) and growth (G) ratios defined above, although the coefficient for the G term in Equation (6.11d) is rather weak. This importance of ROC, enshrined in our cost ratio $R_{cost}$, brings to mind the assertion that Graham and Dodd made almost half a century ago in the book that has come to be known as the Bible of security analysis. They were amongst the first to argue that the *"best gauge of the success of an enterprise is the percentage earned on invested capital"*[34].
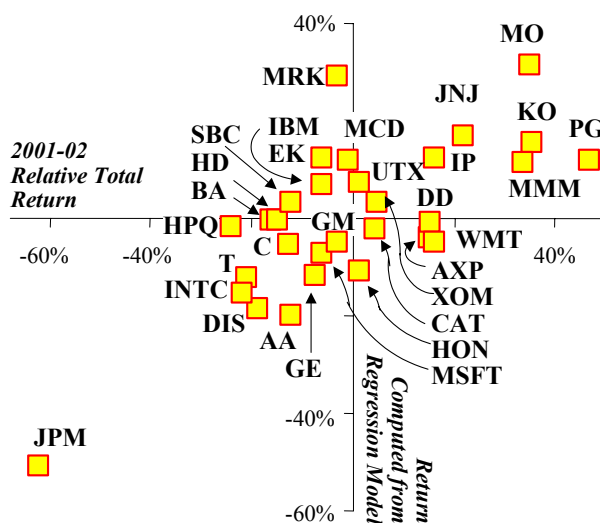
*Exhibit 6.21*

*The 2001-02 total returns of Dow companies relative to the Dow index (horizontal axis) are mimicked closely by the model returns (vertical axis) computed from Equation (6.11d). This model is based on multiple regression analysis of the two variables in Exhibit 6.19 together with the Morningstar valuation data of Exhibit 6.15 and carries a multiple R of 0.72.*

How would an investor scan all the miscellany of factors that affect a firm's prospective performance in the market? A good starting point would be to exploit the wonderful opportunities that the Internet offers. Instead of being overwhelmed by the valuation formulae, why not visit the different web-sites that offer to value a stock? Valuepro.net and quicken.com perform cash flow analyses, for instance. Morningstar also provides a rating sheet that you can customize, as Exhibit 6.22 illustrates (we have added the dividend yield data) for the Dow components. You have thus saved the energy that you need to make the judgement call based, for instance, on the cost ($R_{cost}$) and growth (G) ratios that are identified here.

*Exhibit 6.22:*

*The Morningstar valuation criterion and end-July 2002 ratings for Dow components (you can multiply these ratings with any factor that you decide).*

| Company | Ticker Symbol | Dividend yield | MorningStar crieterion and ratings (0 = Lowest, 10 = Highest) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Growth | Profitability | Financial | Below 52-week high | Low P/E | Low PEG* | 5-year EPS growth* | Net margin | Total Score |
| Aluminum Co. of America | AA | 2.33% | 9 | 6 | 7 | 8 | 3 | 7 | 7 | 3 | 50 |
| American Express | AXP | 0.88% | 4 | 7 | 8 | 3 | 5 | 6 | 6 | 7 | 46 |
| AT & T | T | 1.34% | 2 | 6 | 8 | 10 | 0 | 1 | 6 | 1 | 34 |
| Boeing | BA | 1.80% | 8 | 5 | 4 | 6 | 1 | 10 | 9 | 2 | 45 |
| Caterpillar | CAT | 3.16% | 5 | 6 | 3 | 5 | 6 | 5 | 6 | 4 | 40 |
| Citigroup | C | 2.01% | 6 | 6 | 8 | 7 | 9 | 10 | 8 | 0 | 54 |
| Coca Cola | KO | 1.55% | 8 | 10 | 8 | 2 | 2 | 1 | 5 | 9 | 45 |
| Disney | DIS | 1.28% | 5 | 6 | 7 | 9 | 10 | 2 | 5 | 4 | 48 |
| DuPont | DD | 3.44% | 4 | 10 | 10 | 4 | 10 | 3 | 3 | 10 | 54 |
| Eastman Kodak | EK | 5.95% | 4 | 4 | 4 | 8 | 0 | 5 | 1 | 2 | 28 |
| ExxonMobil | XOM | 2.54% | 4 | 8 | 10 | 3 | 7 | 2 | 2 | 5 | 41 |
| General Electric | GE | 2.23% | 9 | 5 | 4 | 5 | 6 | 8 | 9 | 8 | 54 |
| General Motors | GM | 4.26% | 5 | 3 | 3 | 7 | 9 | 7 | 1 | 2 | 37 |
| Hewlett-Packard Co. | HPQ | 2.21% | 10 | 1 | 1 | 7 | 7 | 10 | 1 | 1 | 38 |
| Home Depot | HD | 0.66% | 10 | 10 | 10 | 9 | 7 | 9 | 10 | 4 | 69 |
| Honeywell | HON | 2.45% | 5 | 6 | 8 | 5 | 2 | 8 | 7 | 3 | 44 |
| Intel | INTC | 0.42% | 5 | 8 | 10 | 10 | 1 | 4 | 10 | 6 | 54 |
| International Bus. Machines | IBM | 0.74% | 7 | 8 | 5 | 8 | 5 | 4 | 4 | 5 | 46 |
| International Paper | IP | 2.66% | 5 | 1 | 1 | 3 | 0 | 0 | 0 | 1 | 11 |
| Johnson & Johnson | JNJ | 1.49% | 7 | 8 | 8 | 2 | 4 | 5 | 7 | 9 | 50 |
| McDonalds | MCD | 0.92% | 7 | 8 | 6 | 4 | 6 | 6 | 2 | 7 | 46 |
| Merck | MRK | 2.84% | 9 | 10 | 7 | 6 | 8 | 6 | 3 | 9 | 58 |
| Microsoft | MSFT | 0.00% | 8 | 10 | 10 | 6 | 3 | 4 | 9 | 10 | 60 |
| Minnesota Metals & Manuf. | MMM | 1.93% | 5 | 10 | 10 | 1 | 4 | 3 | 5 | 8 | 46 |
| JP Morgan | JPM | 5.12% | 3 | 1 | 5 | 7 | 5 | 0 | 0 | 0 | 21 |
| Phillip Morris | MO | 4.49% | 10 | 10 | 5 | 1 | 9 | 9 | 4 | 7 | 55 |
| Proctor & Gamble | PG | 1.82% | 6 | 8 | 6 | 1 | 2 | 2 | 3 | 6 | 34 |
| SBC Comm. | SBC | 3.90% | 1 | 8 | 7 | 9 | 8 | 8 | 2 | 8 | 51 |
| United Technologies | UTX | 1.57% | 9 | 8 | 8 | 4 | 8 | 9 | 8 | 6 | 60 |
| WalMart | WMT | 0.56% | 10 | 8 | 6 | 2 | 3 | 3 | 8 | 3 | 43 |

* projected

## 6.4.3  Fundamental valuation and trading signals

The wide dispersion of valuation numbers raises two issues. One, it helps us understand why stock prices tend to be so volatile. Two, it makes us wonder if, and to what extent, we can use the valuation numbers as trading signals.

The $49.71 – $73.68 range of Microsoft share prices during 2001 hardly seems outrageous, after all, if we compare it with the $51.40 – $78.93 range of our own valuation of these shares based on the mid-year 2001 data. This wide range of valuation numbers gets even wider when we include the data in Exhibit 6.15. Likewise, the valuation numbers for United Technologies (UTX) computed in the preceding pages range from $92.68 to $176.36, compared to the 2001 fluctuation in UTX share prices from a low of $41.02 to the high of $85.65.

Theory too points to the problems inherent in reaching a *fair* price. Efficient market hypothesis follows from the economic theory of rational expectations in which, as Box 6.3 explains, a slight change in the investor demand function can force price oscillations and even run-away spirals. The tendency of market returns to revert to their long-term mean makes it hard to model even the worst bubbles through such spirals.

The quest therefore continues for a signal, or signals, that can guide our trading activity. After all, a signal that can warn us about an impending fall is just as good as the one that portends an imminent interval of rapid rise. The former can help us preserve the gains that the latter can help us realize. One way to look for such signals is to look at the overall economy. After all, the growth of overall economy has emerged as a necessary precondition for the market's ongoing bear-run to end (section 3.1), and yield-spread and GDP-gap seem to hold usable clues to the market's likely trend. But, as we saw in Chapter 4, such signals have become poorer predictor's of the macro-economic trends than they once were. The problem becomes more complex for the market's valuation because we then confront the added uncertainties associated, as we saw earlier in this section, with equity valuation. But logic also tells us that, if identifying the *fair* price is so uncertain, then there must be extended periods of over- and under-valuation of the equities and the market. This is precisely what makes it so important to examine the success of recent calls[35] — popularized in the best-sellers by Messrs. Shiller, Smithers and Wright for instance — that labeled the 1998 and 1999 U.S. stock markets as overvalued. Let us therefore turn to the P/E ratios and q statistic, to see if their success in identifying the market's overvaluation in the late 1990s indeed implies the presence of a predictive power that we have failed to see as yet.

Exhibit 6.23 tests the possibility of market timing based on the P/E ratio. The idea here is to enter the market when this ratio is low, and exit when it is high. Let us use the market's own statistics to identify as to how high is really *high*, and how low is really *low*? Suppose that the annual closing P/E ratios over the 1871-2001 history of S&P-500 index are normally distributed. We would then select any bottom percentile of this distribution to

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## Box 6.3: Price fluctuations and the theory of rational expectations

Efficient market hypothesis is an extension of the theory of rational expectations that was first postulated by John Muth* in 1961. Let us use the Marshallian demand curve and apply Muth's original proposition, that all economic parameters are known and that no other random factors affect the supply-demand relationships. Suppose the price $P_t$ of $Q_t^S$ equities available for trade at time $t$ is given by the equation

$$P_t = \alpha_S + \beta_S Q_t^S$$

where $\alpha_S$ and $\beta_S$ are the known economic parameters. Let the investors' (or buyers') demand function for $Q_t^B$ of these equities at an expected price $E(P_t)$ be defined by the equation

$$E(P_t) = \alpha_B - \beta_B Q_t^B$$

where $\alpha_B$ and $\beta_B$ are the known economic parameters, and $E(P_t)$ is based on some precise valuation model, say. The equilibrium price $P^*$ and quantity $Q^*$ can be then estimated as

$$P^* = E(P_t) = P_t = (\alpha_B \beta_S + \alpha_S \beta_B)/(\beta_B + \beta_S) \text{ and}$$
$$Q^* = Q_t^B = Q_t^S = (\alpha_B - \alpha_S)/(\beta_B + \beta_S)$$

Random fluctuations can still occur, despite the model's original premise, depending on how $E(P_t)$ is determined. For instance, $P_t$ itself can be a random variable of the form $Q_t^B = f(P_t| I_{t-1})$ where $I_{t-1}$ denotes the information available at time t-1. Suppose $E(P_t) = P_{t-1}$, i.e., yesterday's closing price today's expected price. In that case, the equilibrium price $P^*$ is reached through a price-quantity *"cobweb"* of the kind shown in the top panel in the Exhibit here.

Notice that, as demand rises from schedule $B_0$ to $B_t$, the original price $P_0$ at quantity $Q_0$ is pushed up (path 1), so raising the quantity by bringing more sellers into the market (path 2) but lowering the price (path 3). The process would continue (e.g., paths 4 and 5) and eventually settle at $P^*$ and $Q^*$. This mimics the price fluctuations so typical of the equity markets.

As the bottom panel in this Exhibit shows, the opposite behavior is also possible in this model, with prices explosively spinning out of control. The only difference between the two panels is in terms of the slope of the demand function. Theoretically, it follows from the assumption

$$E(P_t) = P_{t-1} = f(P_{t-1}, P_{t-2}, ..., P_{t-n}) \quad \text{that} \quad P_t = (P_0 - P^*)(-\beta_S/\beta_B)^t + P^*$$

Here, $P_t$ approaches $P^*$ only if $(-\beta_S/\beta_B) < 1$. Price oscillations occur when this condition is satisfied. When it is not, the result would be the explosive price-spiral seen in the bottom panel here.

While the observed data do show the kind of oscillatory price behavior modeled in the top panel here, and the observed mean reverting property of market prices suggests that the equilibrium is often established over a long period of time, it is doubtful if the market's behavior in the 1990s can be modeled by the bottom panel in this Exhibit. Interestingly, though, if such price-patterns exist then they should also show up in volatility. On comparing the Sharpe ratio of returns on the market with that of the long-term Treasuries, on the other hand, we find that the volatility of the latter has been rising while that of the former has been falling. The rising volatility of Treasuries is easy to understand within the CAPM framework, as their yields too have been improving. The results in the bottom panel of the Exhibit here do hold a lesson against the advocacy of central bank's direct meddling into the stock market behavior, however. Note that the interest rates are modulated directly by the Fed's policies, although the question whether the Fed acts on its own or merely responds to the market conditions remains hard to settle.

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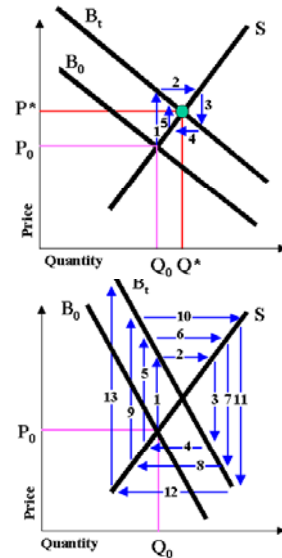
\* John Muth: "Rational Expectations and the Theory of Price Movements", *Econometrica* (July/August, 1961): pp. 315-335. See also T. Sargent & N. Wallace: "Rational Expectations and the Theory of Economic Policy", *Journal of Monetary Economics* (April 1976): pp. 169-183.

§ Walter Nicholson: *Macroeconomic Theory* (Dryden, 1996).

identify the *lows* and the corresponding top percentile to identify the *highs* by selecting, for normal distribution, any of the following cut-off points:

| | | |
|---|---|---|
| | mean $\pm$ 1.283 × standard deviation | for the $10^{th} - 90^{th}$ percentile range |
| | mean $\pm$ 0.675 × standard deviation | for the $25^{th} - 75^{th}$ percentile range |
| and | | |
| | mean $\pm$ 0.440 × standard deviation | for the $33^{rd} - 67^{th}$ percentile range |

For the 15.07 average (standard deviation = 5.09) of P/E ratios in our database, these cut-off points are as given in Exhibit 3.62. As this Exhibit shows, the best returns were obtained by those who bought when P/E was below its bottom $10^{th}$ percentile and sold after holding for 10 years, whereas selling at this P/E naturally gave the worst of the returns here. For the 6.38% mean of all the 121 annual returns in our database and the corresponding standard deviation value of 4.90%, Exhibit 3.62 shows that above-average returns have always accrued to the investments that were

    (a)  made at the *low* P/Es and held for 10 years, or
    (b)  sold at the *high* P/Es after having been held for 10 years.

This is irrespective of how these lows and highs are defined, i.e., whether the cut-off points are at 10% or 25% or 33%. The only other consistent pattern seen here is that *selling at the low P/E is not a good idea* at all.

We need not have carried out all this detailed analysis to reach this conclusion, of course. Common sense itself would identify selling at a low P/E either a desperate action or an exercise in poor judgement.

| | Real total returns per year for those ... | |
|---|---|---|
| | ... who sold at the P/E signal after having held for 10 years | ... who bought at the P/E signal and sold after holding for 10 years |
| **High P/E** | | |
| (a) Top 10% | 10.49% | 9.34% |
| (b) Top 25% | 8.90% | 5.72% |
| (c) Top 33% | 9.03% | 3.83% |
| **Low P/E** | | |
| (a) Top 10% | 0.23% | 12.05% |
| (b) Top 25% | 2.24% | 10.23% |
| (c) Top 33% | 3.05% | 9.17% |

*Exhibit 6.23*

*Total annual returns (real) for 10-year holdings on using the market's P/E ratio to make the buy and sell decisions. For comparison, the average return for all the 10-year holdings, numbering 121, in the real 1871-2001 total return index for S&P-500 (annual data) that we have used here is 6.38%, with a standard deviation of 4.90%.*

As for buying at the high P/Es, though, the results in Exhibit 6.23 are mixed. How about the investors who had bought at the top 10th percentile of these P/Es and sold after holding for 10 years? Based on the results in this Exhibit, their annual returns were superior to those who either did the same with the bottom one-third of the P/Es or sold at either the top one-third or the top quartile of the P/Es.

Using the high P/E ratios to build a divesting strategy is likely to be of dubiously value, therefore. Indeed, other than seeking to gain the most by vigorously investing every time the P/E ratio falls precipitously, it is hard to formulate an all weather strategy of market timing that can give consistently superior returns over a reasonably protracted investment horizon. The fate of the q statistic is hardly much different. This is because, as we saw in Chapter 2, the signals from the two indicators are broadly similar.

Exhibit 6.24 explores this by comparing these data for the history of S&P-500 index with the corresponding real total returns for 10-year holdings

***Exhibit 6.24:***

*Comparing the P/E ratios and 'q' statistic with annualized price changes and total returns for 10-year holdings. P/E ratio and q data here are the same as in Exhibit 3.7, and are shown as log-deviations from their respective mean values. The top panel displays the time series data while the two bottom panels present the corres-ponding power spectra obtained by the Fourier analyses of annual time-series data from the top panel. The spectra have been computed by first detrending each data series, by the simple expedience of subtracting the average, and then adding zeros to make each time series 128 years long. The numbers for the harmonics shown in the power spectra here therefore mean the number of cycles in 128 years.*
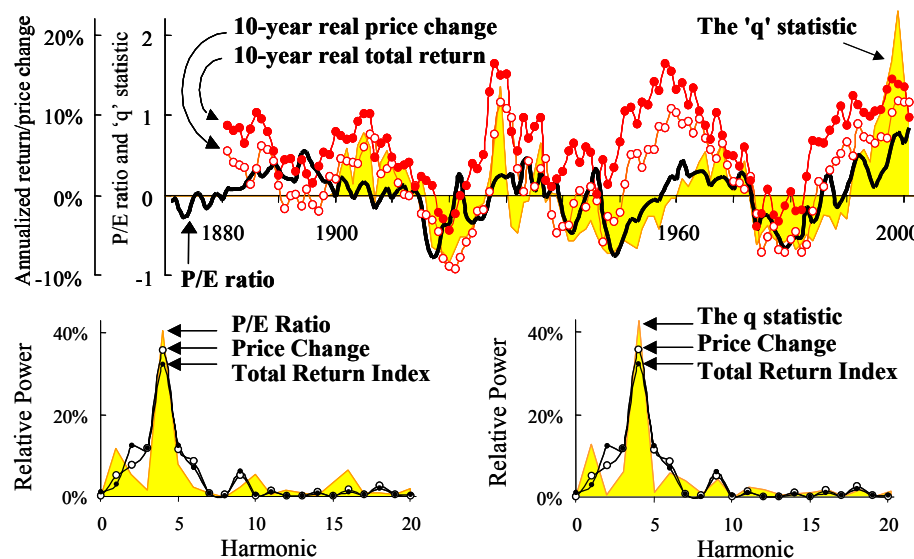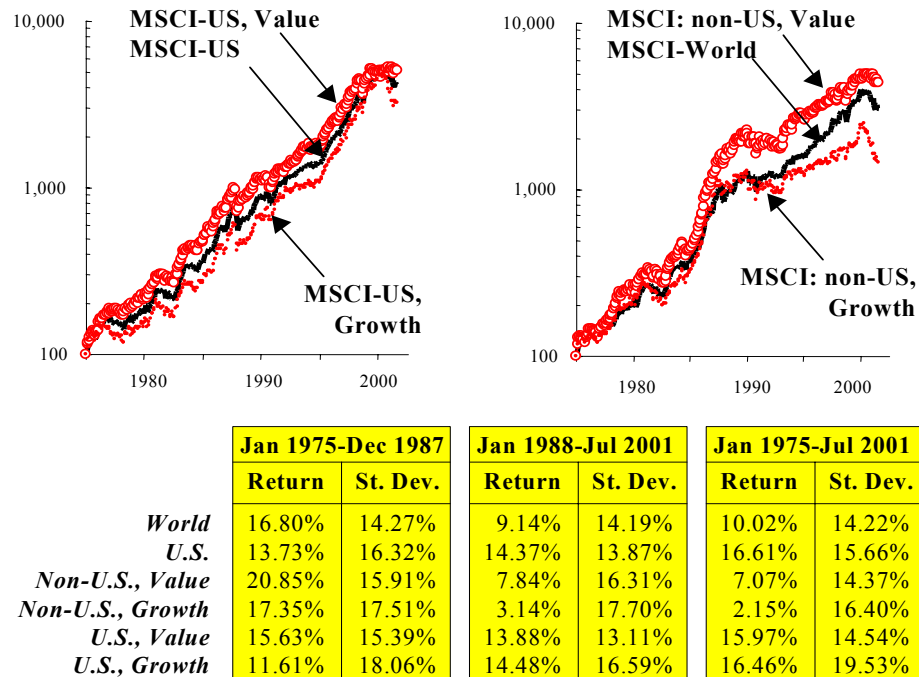
and real price changes (or capital gains) for the same holdings. The top panel in this Exhibit compares these time-series data. The P/E and q data here are those used in Exhibit 3.7 earlier, i.e., rather than looking at the data, we are looking at their logarithmic deviations from the mean. Notice how differently these signals have moved over time. Neither the P/E ratio nor the q statistic would have helped us pick the peak of the bull market of late 1950s – early 1960s, for instance, because both these statistics were hovering about their averages then. The bottom panels in Exhibit 6.24 compare the corresponding power spectra. This is a convenient way to identify the dominant cyclicities in any time series, and is particularly appropriate here because all the four datasets in the top panel of this Exhibit have pronounced cyclicities. Notice that all the four spectra show a dominant peak at the 4th harmonic. Since we have used 128 annual data here, this corresponds to a 32-year cycle (i.e., 4 cycles in 128 years). But this is the only significant harmonic that is common to all these spectra. The spectra for P/E ratio and q statistic also display a subordinate peak at 128-year cyclicity that the returns and price change data lack. As this analysis only seeks a spectral comparison of the four time-series data, and not their spectral decomposition to identify the sources of the component harmonics, it would suffice to note here that spectral analysis too discourages the use of P/E ratio and q data for investment timing decisions.

Apparently, while the P/E ratio and the q statistic have provided 100% success in identifying the overvaluation of 1990s market, the historical data examined here fail to identify them as the indicators for devising a reliable market-timing based investment strategy.

Does this mean that valuation offers no advantage to an investor? Of course not, as we saw in Equation (6.11d). Indeed, the general experience has been that value stocks have given 4% or better in annual returns than the so-called growth stocks. As is evident from Exhibit 6.25, where we graph the growth of $100 invested in the *value* versus *growth* segments of the U.S. (top left) and world (top right) indexes and compare the corresponding annual return statistics (bottom panel), the value stocks have generally performed better than the growth stocks. The U.S. data show higher annualized returns for growth stocks, particularly since Jan 1988, and thus seem the exception to this pattern. This is only superficial, however. Note that the value segment of the U.S. stocks has lower average-to-standard deviation ratios than the growth segment. By definition, value stocks have higher book-to-market value ratios than the growth stocks. Valuation matters, therefore, as we have shown in Equation (6.11d), but by way of book-to-market value ratio rather than the P/E ratio. This relation between return and market value is not new. It was first pointed out by Rolf Banz[36] in 1981 and has since been the subject of an extensive study by Fama and French[37].

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*Exhibit 6.25:*

*The top panels show how a $100 investment would have gained, in nominal dollars, in the value and growth segments of market indexes, during the Dec 1974 – July 2001 period. Bottom panel summarizes the corresponding return statistics. The data compared here are the MSCI (Morgan Stanley Capital International) indexes.*



|  | Jan 1975-Dec 1987 | | Jan 1988-Jul 2001 | | Jan 1975-Jul 2001 | |
|---|---|---|---|---|---|---|
|  | Return | St. Dev. | Return | St. Dev. | Return | St. Dev. |
| *World* | 16.80% | 14.27% | 9.14% | 14.19% | 10.02% | 14.22% |
| *U.S.* | 13.73% | 16.32% | 14.37% | 13.87% | 16.61% | 15.66% |
| *Non-U.S., Value* | 20.85% | 15.91% | 7.84% | 16.31% | 7.07% | 14.37% |
| *Non-U.S., Growth* | 17.35% | 17.51% | 3.14% | 17.70% | 2.15% | 16.40% |
| *U.S., Value* | 15.63% | 15.39% | 13.88% | 13.11% | 15.97% | 14.54% |
| *U.S., Growth* | 11.61% | 18.06% | 14.48% | 16.59% | 16.46% | 19.53% |

The question, then, is one of being able to formulate a simple and inexpensive investment strategy to benefit from this finding. In this context, an interesting result comes from Haugen's argument[38] that, instead of giving better returns to the investors who take greater risks, the market compensates those investors who reduce their risk. Apparently, fortune does not favor the brave! Haugen makes his point by constructing a minimum variance portfolio from S&P-500 stocks from monthly returns two years to the date, then adjust the portfolio every quarter, and compare the resulting returns with those of a similar maximum variance portfolio. Part of his results for NYSE stocks over the 1928-92 period are shown in Exhibit 6.26, along with those in Bilson's[39] extension of this study to the global market place. Rather than making a persuasive case to discard the efficient market hypothesis, what these results show is that we can realize better returns on our investment dollars if we design and use a minimum variance portfolio instead of staying with the total market index.

| NYSE (1928-92) | | International | | Exhibit 6.26 |
|---|---|---|---|---|
| **Minimum Variance** | **Index** | **Minimum Variance** | **Index** | |

| | NYSE (1928-92) | | International | |
|---|---|---|---|---|
| | **Minimum Variance** | **Index** | **Minimum Variance** | **Index** |
| *Average* | 10.80% | 9.80% | 19.26% | 14.91% |
| *St. Dev.* | 17.90% | 20.20% | 13.06% | 13.27% |
| *Ratio* | 0.60 | 0.49 | 1.47 | 1.12 |

*Exhibit 6.26*

*Haugen's results for the NYSE stocks, and Bilson's matching results for international portfolio, show that index is not a minimum variance portfolio.*

One way to formulate a simple and inexpensive investment strategy would thus be to combine the merits of Exhibits 6.25 and 6.26, by designing a portfolio of domestic and international value stocks. Exhibit 6.27 below summarizes the results of such a strategy, from the perspectives of the U.S. as well as Japanese investors. The reason for selecting these two examples is obvious. The U.S. stock markets have performed very well, particularly in the recent years when they have effectively led the world's stock markets, whereas the Japanese market has been a laggard. Thus, if a strategy works well in these two extreme situations, then there is a good case to be made for its wider applicability elsewhere. This is indeed the case here. Note that, by constructing the minimum variance portfolios of domestic and foreign value stocks, U.S. investors are just as better off as the Japanese investors, even though the performances of their respective domestic stock markets have been so dissimilar.

| | For U.S. Investor | | | For Japanese Investor | | |
|---|---|---|---|---|---|---|
| | Return | Standard Deviation | Sharpe Ratio | Return | Standard Deviation | Sharpe Ratio |
| All Domestic Stocks | 14.06% | 15.10% | 0.49 | 7.29% | 20.64% | 0.18 |
| All Domestic Stocks, Value | 14.73% | 14.25% | 0.56 | 10.34% | 19.94% | 0.34 |
| All Foreign Stocks, Value | 14.20% | 16.20% | 0.46 | 11.23% | 15.67% | 0.29 |

| | For U.S. Investor | For Japanese Investor |
|---|---|---|
| **Proportion** | | |
| (a) Domestic Stocks | 65% | 35% |
| (b) Rest-of-World Stocks | 35% | 65% |
| **Return** | 14.55% | 11.47% |
| **Standard Deviation** | 13.16% | 14.10% |
| **Sharpe Ratio** | 0.60 | 0.52 |

*Exhibit 6.27*

*Tabulated above are the statistics of domestic and foreign value and growth stocks, from the perspectives of U.S. and Japanese investors, as computed from the MSCI indexes. Shown alongside are the corresponding minimum variance portfolios.*

### 6.4.4 Towards a fair model of market valuation:

This brings us back to the pressing question of market valuation that we had raised at the beginning of this section. Note that the P/E ratio does give a good indication of whether the market overall, or an equity individually, can be considered overvalued or not. After all, as we saw in Box 2.1, P/E is the reciprocal of ROE (return on equity) when market value and book value are comparable. As this condition translates into $q = 1$, it is not surprising to find (e.g., Exhibit 6.24) that q and P/E parallel one another. Indeed, a popular way to look at whether this ratio is high or not has been to find, as in the studies[40] by Heaton and Lucas and Diamond, the growth rates in the Gordon Growth model that would justify the market's current price. The Heaton and Lucas study suggests that, compared to the past century's average growth rate (g) of 1.4% and P/E ratio of 14, a real annual stock return of 7% in the future would require an expected annual growth rate of 4.9% if the market's P/E ratio averages 24. This is a tall order and demands the P/E ratio to fall.

To examine what can facilitate this fall, consider a firm that pays out all its earnings as dividends. Next year's dividend, $D_1$, would thus be the same as next year's earnings $E_1$. Equations (3.3) and (6.5d) then give

$$\frac{P_0}{E} \quad = \quad \frac{1}{(k_e - g)} \quad = \quad \frac{1}{k_e} \quad + \quad \text{PVGO} \tag{6.12a}$$

$$\text{where} \quad \text{PVGO} \quad = \quad \frac{g}{k_e \times (k_e - g)}$$

is the present value of future growth opportunities and $P_0$ is the current price. To derive this expression for PVGO, just note that this factor in Equation (3.3) is a geometric series so that, for the nomenclature used here,

$$[(g/k_e) + (g/k_e)^2 + (g/k_e)^3 + \ldots] \quad = \quad g/(k_e - g) \tag{6.12b}$$

For the P/E ratio to fall, then, we need a rise in $k_e$ or a drop in PVGO or a drop in price. This raises several possibilities:

- Price could drop significantly if a sizeable proportion of stockholders either decides or needs to liquidate, e.g., during a market crash, when the retiring baby-boomers start withdrawing from their 401(k)s and IRAs, say towards 2010, or a flight of the foreign capital that has been pouring into the U.S. market.

- – The discount rate, or the cost of equity, could rise if the equity premium rises or the interest rates rise, say bringing the 1970s back.
- – The growth rate could decline either because the economy runs out of steam or because the U.S. productivity may well be past its prime already[41], or the maturing U.S. economy starts to mimic the ways of a mature economy as that of Western Europe.

Interesting as these possibilities are, they all require a reversal of the long-term trend, however. As can be seen in Exhibit 6.28, for instance, the reciprocal of $P_0/E$ ratio, called the capitalization rate, has broadly followed the ups and downs in the long-term bond rates since 1960. Also notice how the spread between this rate and the 10-year Treasury bills has been negative since the early 1980s. Recall how this spread effectively compliments that in Box 3.3 between the total return on the market and the market's return on equity (ROE). A declining interest rate environment is generally good for stocks and, as we saw in Box 3.3, the U.S. stock market's boom since the early 1980s amply testifies to this fact.
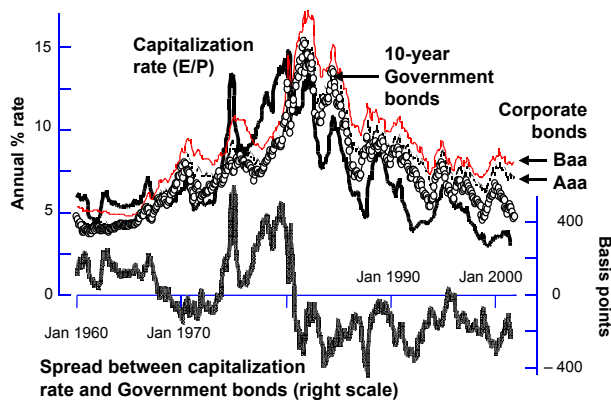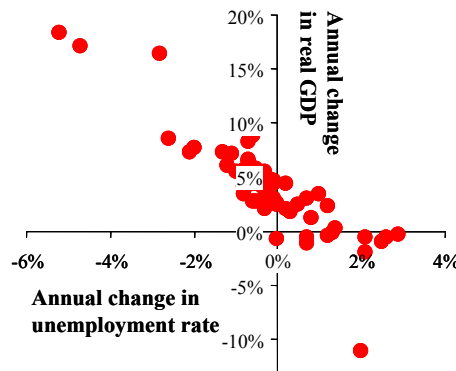


**Exhibit 6.28**

*Changes in the capitalization rate $(E/P_0)$ for S&P-500 index since January 1960 have generally followed those in the interest rates. This rate has also been persistently below the 10-year Treasury bills rates since 1980.*

Interest rates can only come down so much, however. The current 1.75% Fed Fund rate has a lot less room to fall, after all, than in January 1981 when it stood at 19.08%. It may already be in the negative territory if we factor the inflation rate in. Once again, therefore, we face the perennial need to precariously balance[42] high growth with low inflation. Such thinking can be wise if it saves us from reverting to the inflationary spiral of the late 1970s and early 1980s but is not a meaningful proposition, as a long-term strategy, short of seeking to violate the economic fundamentals. For instance, Exhibit 6.29 shows how well Okun's law, proposed by the economist Arthur Okun[43] as a linear relation between the rises in unemployment and drops in GDP, has held over time. As a rough rule of thumb, this law suggests a 2-3%

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growth in output for each percentage point drop in the unemployment rate. The regression analysis of 1940-2001 data in this Exhibit suggests that the effect may be stronger still. With the unemployment rate barely 1% above what economists generally take to be its natural level in the U.S., and the GDP barely 2% below its potential in the second quarter of 2002, clearly there is not much room before the economy starts overheating.

**Exhibit 6.29**

*These data for the 1940-2001 period amply testify to the validity of Okun's law that the GDP drops when unemployment rate rises. The correlation coefficient here is –0.88. If we exclude the isolated point that represents 1946 (2% unemployment rise, 12% GDP drop), and use per capita GDP, then this co-efficient rises to an even more significant value of –0.91!*

The market's sensitivity to the overall economy is often masked, as we saw in Chapter 2, by the fact that it fluctuates far more frequently than the economy does. This tendency is clearly brought out in Exhibit 6.30, where we compare the annual changes in real per capita GDP with those in the real earnings per share of S&P-500 companies for the 1929-2001 period. The two display a direct relationship, overall, though not in the same crisp and clear-cut manner as seen between the changes in unemployment rate and GDP in Exhibit 6.29. Despite the scatter, Exhibit 6.30 suggests that each 1% change in the GDP can bring about up to 4% or greater change in corporate earnings. The multiplier effect of GDP on the market thus has the same magnitude as that of the unemployment rate on GDP.
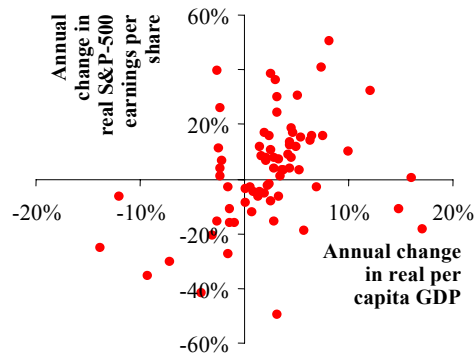
**Exhibit 6.30**

*These 1929-2001 real annual data show that changes in the GDP tend to have a direct effect on the changes in corporate earnings.*

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This is a hopeful picture because the economy, performing below its potential in mid-year 2002, clearly has room to grow. The question now is whether the market has. What if it has yet to correct itself to its appropriate level? And, if so, to what level? These questions are hard to answer with any modicum of certainty, because they call for the market's valuation whereas, as we have seen earlier in this Chapter, even single equities are hard to value precisely. If we go by the historic P/E-based Campbell-Shiller model, then the August 21, 2002, closing price of 949.36 and year 2002 'reported' earnings estimate of $34.11 made the S&P-500 index grossly overpriced. These numbers give the index a P/E ratio of 27.8, which is way above its historic average of 15. Even the 2002 year-end operating earnings estimate of $44.70 gives the index a P/E ratio of 21.2 which, though better than the August earnings estimate, makes the index pricey at its 949.36 value. Thus measured, the mid-year 2002 market is far from being under-priced. Much like the *Dogs of Dow* strategy that we discussed in Box 5.5, though, this is a backward looking measure because it ignores the fact that technology stocks that now make up almost one-fifth of the S&P-500 index usually have high growth and high P/Es. A decade ago, when its P/E was at about its historic average, the index was dominated by the low P/E sectors like automobiles, oil and other cyclicals, and was weighted barely two-fifths as much in the technology sector as it now is.

An alternative to this is the Fed model, so christened by Dr. Edward Yardeni[44] who gleaned it from the Fed Chairman Alan Greenspan's August 1997 report to the Congress. It identifies fair value P/E as the reciprocal of the yield on 10-year Treasury bonds and thus considers the index overpriced if the bond yield exceeds the S&P-500 earnings yield. For 10-year bond yield at 4.228% on August 21, 2002, the resulting fair value P/E is 23.65. Thus, based on the $44.70 operating earnings estimate for 2002, the S&P-500 index would be fairly valued at 1057.16 whereas, if we use the $34.11 reported earnings estimate, then the fair value would be about 20% less. You decide if this makes the index pricey at its 949.36 August 21, 2002 closing value.

A recent regression[45] analysis at the San Francisco Fed examined the 1926-2001 S&P-500 P/E ratios against the yields on long-term government bonds and volatilities of monthly stock and bond returns over the preceding 20 years. The resulting 2002 closing value of 876 for the index is only slightly above its mid-2002 dip. This too suggests that, at 949.36, the market can be hardly considered undervalued. Our extension of this model by adding retention rate and annual stock returns, and using annual instead of monthly data, gives an astounding result. As shown in Exhibit 6.31, our computed values match the index very closely over the 1900-2001 period, with multiple R at 0.8774 and $R^2 = 0.76999$. It thus explains 77% of the variance. Equation (6.13) is the result.

*Exhibit 6.31:*

*The real (solid line) versus computed (open circles) values of the S&P-500 index, the latter based on equation (3.22) whose coefficients were obtained, as discussed in the text, by multiple regression analysis of 1900-2001 annual data.*
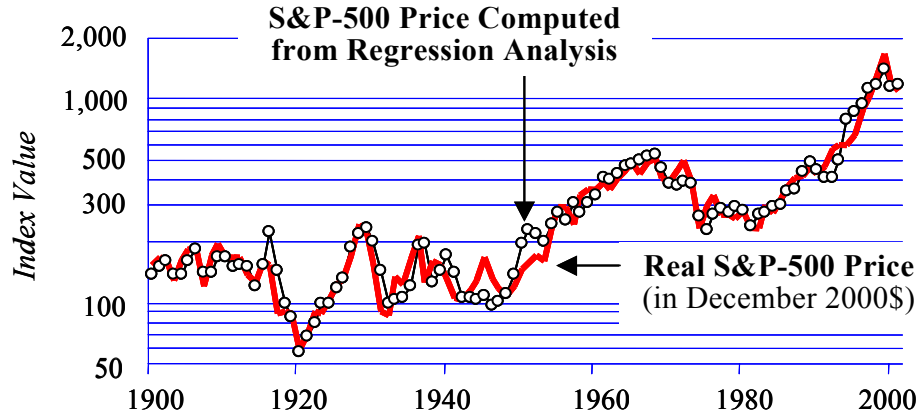


$$P_{S\&P\text{-}500} = 17.5314 \times E$$
$$\times \; exp\left[ \; \frac{0.0015}{r_{10\text{-yr}}} - 0.987\,RR \; + 7.0477\,\tilde{r}_{S\&P} \right.$$
$$\left. - 3.5734\,\sigma_{S\&P} + \; 5.0167\,\sigma_{r10\text{-yr}} \; \right]$$
(6.13)

Here, $E$ = average annual earnings (real) for the S&P-500 index

$r_{10\text{-yr}}$ = average annual yield on the 10-year Treasuries

$RR$ = retention ratio = $(E - D)/E$ for the S&P-500 index

$\tilde{r}_{S\&P}$ = average annual total returns (real) on the S&P-500 index, computed from the preceding 20 years of annual data

$\sigma_{S\&P}$ = standard deviation of annual total returns on S&P-500 index, computed for preceding 20 years of annual data

$\sigma_{r10\text{-yr}}$ = standard deviation of annual yields on 10-year Treasuries over the preceding 20 years.

Based as they are on the 20-year averaging of annual data, our $\tilde{r}_{S\&P}$, $\sigma_{S\&P}$ and $\sigma_{r10\text{-yr}}$ statistics do not change drastically from one year to another, although, as we have shown earlier, they do harbor significant long-terms

trends. For annual estimates, therefore, Equation (6.13) suggests that the index value is most sensitive to corporate earnings (E) and 10-year Treasury yields ($r_{10\text{-yr}}$). For instance, if $r_{10\text{-yr}}$ = 5.5% this year, then, with $r_{S\&P}$ = 10.5%, $\sigma_{S\&P}$ = 13.5% and $\sigma_{r10\text{-yr}}$ = 11.5%, Exhibit 6.32 shows that the 2002 closing values for the S&P-500 values should range from 856 to 1223, based on Equation (6.13), for the corresponding EPS (earnings per share) estimates of $35 to $50. For E = $36.34, the number used in the San Francisco Fed estimate of 876, Equation (6.13) gives the index a 2002 closing value of 889. Instead, if the earnings turn out to be $44.70, then the index should be 1090. For comparison, the index closed at 1148 in 2000 when the earnings per share were $50!

**Exhibit 6.32:**

*Estimates of 2002 closing values for the S&P-500 index using Equation (6.13).*

| With the 2002 earnings per share for S&P-500 as ... | ... Equation (6.13) gives 2002 closing value of the S&P-500 index as ... | |
| --- | --- | --- |
| | **Expected value** | **Range at 95% confidence level** |
| $35 | 856 | 829 — 882 |
| $40 | 978 | 948 —1,009 |
| $45 | 1,100 | 1,066 —1,135 |
| $50 | 1,223 | 1,185 —1,261 |

However desirable it may be, fitting an equation to the data does not necessarily translate into predictability. As Lord Kelvin[46], the renowned 19th century mathematician and physicist, once noted, fitting a physical phenomenon to a random function implies admitting that you do not understand the mechanism. Be that as it may, note that the fit in Exhibit 6.31 clearly demonstrates the market's efficient response to corporate earnings, to the expectations of economy's future (as captured in the Treasury yields and their volatility), and to its own history of long-term performance, in terms of returns and risks.

Another issue concerns the rationality of the investor and takes us back, therefore, to the entire debate on the efficient market hypothesis. The fact that we are able to model the market's 1871-2001 history of performance in terms of corporate earnings, retention rate and the risk-return trade off between stocks and bonds itself makes it hard to call either the investor or the market crazy. This also explains the property of mean reversion, as a matter of fact, as the work of the slowest of the innumerable feedback loops, as part of an in-built servomechanism so to speak, through which the market absorbs

information. The efficient market hypothesis is not sacrosanct, of course, and must be discarded it if it fails to describe the data. But the alternatives are far worse and scary. Look back at the Exhibits 3.7 and 6.23, for instance, and you will discover that if P/E and q are the correct valuation measures then the market is either overvalued or undervalued most of the time. Even the statistical criterion for average P/E that we used in Exhibit 6.23 show that, for the P/E signal to be correct, the market can be correctly valued two-thirds of the time at the most (i.e., buying at high P/E should give substantially sub-average returns).

Exhibit 4.39 showed a convergence of risk-adjusted returns on stocks and government bonds, particularly when we looked at their Sharpe ratios. Historically bond yields have been far less volatile than the stock returns, as we saw in Chapter 4. With bond volatility rapidly closing in on that of the stocks, although their returns are yet to match, perhaps we may soon have bonds in the same basket as stocks and not as their alternatives. That may take a while to show up clearly in the data, however, particularly in the form of increasing correlations between the stock and bond returns. In terms of the portfolio theory discussed in this Chapter, this augurs ill for the strategies that use the past 75-year record to allocate between the stocks and bonds to suit an individual investor's utility preference. In such an emerging universe, bonds will look like today's income stocks, with more dividends than capital gains, while the stocks in general will move towards today's growth stocks, but both with comparable volatilities that nonetheless reflect the CAPM-style risk-reward profile. An opposite scenario is equally likely. What if the long-term growth rate of the economy slowed down a little? That would drive the dividend non-payers like Microsoft into a rarity, then. The legendary Warren Buffett's recent description of a stock as a 'disguised bond'[47] may have been a great deal more prophetic in this respect, therefore, than is readily apparent!



FINANCIAL SERVICES

"I can't stop your investments from going down the toilet, but I know a guy who can sell you a nicer toilet."

GLASBERGEN

## 6.5    Concluding Remarks:

We have, in this chapter, examined the different valuation models, their practical applications, and the implications they have for the individual investor.

No matter the efficiency level of the stock market, one must still have a solid benchmark. We document here the fact that the results of valuation would depend very much on the model being used, leaving the typical investor in somewhat of a quandary, to say the least, as to whether a stock is overvalued or undervalued.

It is pertinent to note in this context the recent debacle of the Long Term Capital Management group. It had made wrong bets on valuation, despite the impressive brainpower at its disposal, including two Nobel Laureates. The best that could be said is that, on occasion, we can distinguish overvaluation from under-valuation, and can, therefore, make some reasonable guesses as to the general direction of expected price movement. But determining the level to which the price will move, or the level that could be called the correct price, is an elusive task. The analysts at Goldman Sachs kept defending the business model of e-Toys even as it was being buried into the ground. Their leading "experts" simply would not give up on the company, even after it had piled an incredibly high mountain of debt, after it botched up on the deliveries, and after Amazon.com beat it handily in terms of the total price of toys delivered to the customer.

This chapter has further examined the merits of fundamental analysis, specifically the P/E ratio, and has looked at the "Dogs of Dow" strategy of beating the market. Our conclusion is that they can succeed in exploiting the market inefficiencies, if at all, only if the investor is well-informed. For the majority of us, therefore, it might be a better idea to simply follow the market, hold on for the long term, and tide over its ups and downs by dollar-cost-averaging[48].

In essence, there is no substitute for diligence, a dynamic approach to portfolio management, and for the wisdom: "*if it sounds too good to be true, it often is*."

# Endnotes for Chapter 6

[1] A common stock is evidence of ownership in a corporate entity. It can be a

  —class A common stock: it is issued to the public, ordinarily pays dividends, and carries full voting rights,

  —class B common stock: it is "bought" by the organizers of the corporation and does not pay dividends until the earning power of the corporation is proven, or

  —founder's share: it resembles a class B common stock, except that it carries sole voting rights and guarantees that the control of the corporation remains in the hands of the founders.

[2] Following are some of the finance texts that specifically focus on valuation, of which this section of our treatment draws heavily on Damodaran's book and its excellent website:

  Bradford Cornell: *Corporate Valuation* (Irwin, 1993)
  Aswath Damodaran: *Damodaran on Valuation* (John Wiley, 1994)
  Tom Copeland, Tim Koller and Jack Murrin: *Valuation* (John Wiley, 1995)
  Simon Benninga and Oded Sarig: *Corporate Finance: A Valuation Approach* (McGraw-Hill, 1997).

[3] Following are amongst the most commonly used of these ratios:

$$\text{price-to-earnings (P/E) ratio:} \quad = \quad \frac{\text{stock price (P)}}{\text{earnings per share (E)}}$$

$$\text{price-to-book value (P/B) ratio} \quad = \quad \frac{\text{stock price (P)}}{\text{book value per share (B)}}$$

*This ratio is also called the market-to-book ratio.*

$$\text{price-to-sales (P/S) ratio} \quad = \quad \frac{\text{stock price (P)}}{\text{sales revenues per share (S)}}$$

$$\text{price-to-cash flow (P/CF) ratio} \quad = \quad \frac{\text{stock price (P)}}{\text{Cash flow per share (CF)}}$$

[4] These numbers can be freely downloaded from such financial web-sites as yahoo (finance.yahoo.com), morningstar (www.morningstar.com), quicken (www.quicken.com), cnbc (www.cnbc.com).

[5] The following three factors need to be borne in mind when examining these data for purposes of equity-valuation:

  – It is tempting to assume that ROE = ROA for a debt-free firm like Microsoft. This is not really true, however, because

  total assets = total liabilities (= debt + other liabilities) + shareholders' equity

  For Microsoft, debt = 0 but other liabilities (e.g., accounts payable, accrued compensation, income taxes, unearned revenues etc.) work out to about 25% of its total stockholders' equity, making its equity multiplier $\approx 1.25$ and ROE $\approx 1.25$ ROA.

  – Debt is often integral to a firm's capital structure, and carries tax advantages, but the leverage ratios vary widely from firm to firm. This makes it appropriate to adjust a firm's net income for this tax shield of debt, by subtracting this tax shield (= tax rate $\times$ interest payment) from net income, so that all firms seem 100% equity financed.

  – As employee compensation packages, particularly in the high-tech sector, increasingly include options and such awards carry hidden costs, the net income of a firm with such costs needs to be adjusted in order to reflect this.

[6] Aswath Damodaran's home-page (www.stern.nyu.edu/~adamodar/New_Home_Page/) has an impressive collection of files explaining the numerous quantitative strategies for valuation, interactive excel files for selecting the appropriate valuation strategy and performing valuations, and frequently updated downloadable data.

http://www.stern.nyu.edu/~adamodar/New_Home_Page/datafileMReg97.html

[7] http://www.stern.nyu.edu/~adamodar/New_Home_Page/datafileMReg97.html

[8] William Beaver, "Financial Ratios and Predictors of Failure", Empirical Research in Accounting: Selected Studies, supplement to *Journal of Accounting Research*, vol. 12, pp. 77-111 (1966).

[9] E.I. Altman, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", *Journal of Finance*, vol. 23, pp. 589-609 (1968). See also E.I. Altman, R.B. Haldeman and P. Narayana, "Zeta Analysis: A New Model to Identify Bankrupcy Risk of Corporations", *Journal of Banking and Finance*, vol. 3, pp. 29-54 (1977).

[10] I. Dambolena and S. Khoury, "Ratio Stability and Corporate Failure", *Journal of Finance*, vol. 35, pp. 1017-1026 (1980).

[11] G. Foster, *Financial Statement Analysis* (Prentice-Hall, 1986).

[12] In this case,

$$P_0 = \frac{D_1}{1+k_e} + \frac{D_1}{(1+k_e)^2} + \frac{D_1}{(1+k_e)^3} + \ldots$$

or

$$(1+k_e)\, P_0 = D_1 + \frac{D_1}{1+k_e} + \frac{D_1}{(1+k_e)^2} + \frac{D_1}{(1+k_e)^3} + \ldots$$

so that, by subtracting the first line from the second, we have $\qquad k_e\, P_0 = D_1$

or $\qquad P_0 = D_1/k_e$

[13] We now have

$$P_0 = \frac{D_1}{1+k_e} + \frac{D_1(1+g)}{(1+k_e)^2} + \frac{D_1(1+g)^2}{(1+k_e)^3} + \ldots$$

or

$$\frac{1+k_e}{1+g}\, P_0 = \frac{D_1}{1+g} + \frac{D_1}{1+k_e} + \frac{D_1(1+g)}{(1+k_e)^2} + \frac{D_1(1+g)^2}{(1+k_e)^3} + \ldots$$

so that, by subtracting the first line from the second, we have $\qquad (k_e - g)\, P_0 = D_1$

or $\qquad P_0 = D_1/(k_e - g)$

[14] Myron Gordon: *Finance, Investment and Macroeconomics* (Elgar, 1994). See also M.J. Gordon: "Dividends, Earnings, and Stock Prices", *Review of Economics and Statistics*, May 1959, pp. 99-105; M.J. Gordon and E. Shapiro: "Capital Equipment Analysis: The Required Rate of Profit", *Management Science*, vol. 3, pp. 102-110 (1956).

[15] These numbers can be freely retrieved from the financial sites such as yahoo (finance.yahoo.com), morningstar (www.morningstar.com), quicken (www.quicken.com), cnbc (www.cnbc.com) and the like.

[16] Payout ratio = Dividend/EPS (for UTX, the last 12 months' payout ratio is 21.70%, compared to the industry and sector-wide rate of 42.93% and the market average of 26.11%).

[17] The dividend discount model discussed above presents discounted cash flow analysis in its simplest form.

[18] return-on-capital (ROC) = [EBIT $\times$ (1 – Tax Rate)]/Book Value of Capital

[19] James McTaggart, Peter Kontes and Michael Mankins: *The Value Imperative* (The Free Press, 1994). Alfred Rappaport: *Creating Shareholder Value* (The Free Press, 1998); Bennet Stuart: *The Quest for Value* (HarperCollins, 1991, 1998).

[20] What follows is an updated adaptation of the BusinessWeek magazine's cover story, "Valuing an Internet Stock" published in its December 14, 1998, issue.

[21] Sarkis Khoury: *Speculative Markets* (Macmillan, 1984)

[22] Fischer Black and Myron Scholes, "The Pricing of Options ad Corporate Liabilities", *Journal of Political Economy*, vol. 81, pp. 637-654 (1973). The original work by Black and

Scholes applied mainly to the European options, which differ from the American options in that the former can be exercised only at date of expiration whereas the latter can be exercised at any time on or before expiration. R.C. Merton ("Theory of Rational Option Pricing", *Bell Journal of Economics and Management Science*, vol. 4, pp. 141-183, 1973) extended the Black and Scholes model to American options on the stocks that do not pay dividends.

[23] N(d) is the probability for a normally distributed random variable $\xi$ to have a value less than or equal to d.

[24] For the numbers given here, $\sigma^2 = 0.55^2 \times 0.92^2 + 0.45^2 \times 0.12^2 + 2 \times 0.55 \times 0.45 \times 0.25 \times 0.95 \times 0.12 = 0.29$

[25] Richard Brealey and Stewart Myers: *Principles of Corporate Finance* (McGraw-Hill/Irwin, 2003). See also,

M. Amram and N. Kulatilaka: *Real Options: Managing strategic Investment in an Uncertain World* (Harvard Business School Press, 1999).

L. Trigeorgis: Real Options: *Managerial Flexibility and Strategy in Resource Allocations* (MIT Press, 1996).

A. Dixit and R. Pindyck: *Investment under Uncertainty* (Princeton Univ. Press, 1994).

[26] Margaret Popper, "Another Way of Valuing Dot.Coms, Sort Of". *BusinessWeek* (Dec 31, 1999).

[27] Michael Mauboussin and Bob Hiller. "Rational Exuberance?", *Credit Suisse First Boston Equity Research* (January 26, 1999).

[28] Damodaran's home-page (www.sterns.nyu.edu/~adamodar/New_Home_Page) also has a working paper and an excel worksheet with a detailed free cash flow analysis for Amazon.

[29] Ravi Suria, Wai Tung and Peter Kim. "Revisiting Amazon's Liquidity Issues", *Lehman Brothers Global Equity Research* (February 5, 2001).

[30] Mark Kritzman: *Puzzles of Finance – Six Practical Problems and Their Remarkable Solutions* (John Wiley, 2000).

[31] Robert Hagstrom: *The Warren Buffett Way: Investment Strategies of the World's Greatest Investor* (with preface by Peter Lynch)(John Wiley, 1994).

[32] Gabriel Hawawini and Claude Viallet: *Finance for Executives – Managing for Value Creation* (South-Western College Publishing, 1999).

[33] R.C. Higgins: "Sustainable Growth under Inflation", *Financial Management* (Autumn, 1981).

[34] B. Graham,D.L. Dodd and S. Cottle: *Security Analysis — Principles and Techniques* (McGraw-Hill, 1962).

[35] Robert Shiller, *Irrational Exuberance* (Princeton Univ. Press, 2000).

John Campbell and Robert Shiller, "Valuation Ratios and the Long-Run Stock Market Outlook: An Update", *NBER Working Paper* No. 8221 (2001).

Andrew Smithers and Stephen Wright *Valuing Wall Street* (McGraw-Hill, 2000). Unlike the above P/E based studies of Shiller, and Campbell and Shiller, Smithers and Wright base their arguments on Tobin's q, a valuation measure proposed by James Tobin ("A General Equilibrium Approach to Monetary Theory", *Journal of Money, Credit and Banking*, vol. 1, pp. 15-29, 1969). It is defined as

$$\text{Tobin's q} \quad = \quad \frac{\text{the market value of a firm's assets}}{\text{estimated cost of replacing these assets}} \quad = \quad \frac{n \times P + L}{K}$$

or equivalently as $\dfrac{n \times P}{K - L}$ as Smithers and Wright have shown.

Here, P is price, n the number of shares, L the market value of corporate liabilities and K the corporate assets.

Oliver Blanchard, "Movements in the Equity Premium", *Brookings Papers on Economic Activity*, No.2, pp. 75-118 (1993).

John Campbell and Robert Shiller, "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors", *Review of Financial Studies*, vol. 1, pp. 195-228 (1988).

[36] Rolf Banz, "The Relationship between Return and Market Values of Common Stock", *Journal of Financial Economics*, v. 9: pp. 3-18 (1981).

[37] E.F. Fama and K.R. French, "The Cross-Section of Expected Stock Returns", *Journal of Financial Economics*, v. 47: pp. 427-465 (1992). Their updated data can be accessed at the web-site http://www.mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.

[38] Robert Haugen, *The Inefficient Stock Market* (Prentice Hall, 1998). See also Robert Haugen, *The New Finance: The Case Against Efficient Markets* (Prentice Hall, 1995), and Robert Haugen and Nardin Bader, "Commonality in the Determinants of Expected Stock Returns", *Journal of Financial Economics*, v. 41, pp. 401-439 (1996).

[39] John F.O. Bilson, "Haugen's Heroes: Risk and Return in Global Equity Markets" (http://www.stuart.iit.edu/workingpapers/haugen/)

[40] John Heaton and Deborah Lucas, "Stock Prices and Fundamentals" in *NBER Macro-economics Annual 1999* (Ed: Ben Bernanke and Julio Rotemberg), p. 213-241 (1999). Recall similar calculations by Peter Diamond ('What Stock Market Returns to Expect for the Future?', *Social Security Bulletin*, vol. 63, pp. 38-52, 2000) that were mentioned in Chapter 3.

[41] Robert Gordon: "U.S. Economic Growth since 1870: One Big Wave", *American Economic Review*, vol. 89, pp. 123-128 (1999).

[42] Two essays the by noted economist, Paul Krugman, one in *The Economist* ("Stable Prices and Fast Growth: Just Say NO", 1996) and the other in the *Harvard Business Review* ("How Fast Can The U.S. Economy Grow", July/August 1997) provide excellent and easy-to-read explanation of why the zero-inflation and rapid growth propositions must be treated as mutually exclusive.

[43] Arthur M. Okun: "Potential GNP: Its Measurement and Significance", *Proceedings of the Business and Economics Section*, 1962, pp. 98-103, American Statistical Association.

[44] The assertion, that we have deciphered the Fed's code, was made by Dr. Ed Yardeni, then a Deutsche Bank economist and now with the Prudential Securities, based on the Federal Reserve Chairman, Alan Greenspan's Monetary Policy Report to the Congress at his July 22, 1997, Humphrey-Hawkins testimony (www.federalreserve.gov/boarddocs/hh/1997/july/ReportSection2.htm).

[45] This study, using the regression model proposed by Clifford Asness ("Stocks versus Bonds: Explaining the Equity Risk Premium", *Financial Analysts Journal*, vol. 56, pp. 96-113, 2000). has been reported by Kevin Lansing ("Searching for Value in the U.S. Stock Market", *Economic Letter, Federal Reserve Bank of San Francisco*, no. 2002-16, May 24, 2002).

[46] Lord William Thomson Kelvin (1824-1907) contributed to many branches of physics but is to be particularly remembered for his work on the laws of thermodynamics. The first of these laws states that energy is always conserved, in a closed system, either as mechanical energy or as heat energy, or both. The second law, which can be stated either as *heat tends to flow from hot to a cold place* or as *entropy of the universe either remains constant or increases, but never decreases* (the term entropy describes the unavailability of energy), basically means that there is no free lunch. Kelvin argued, for instance, that key issue in interpreting the second law of thermodynamics was the explanation of irreversible processes. He noted that, as entropy always increased, the universe would eventually reach a state of uniform temperature and maximum entropy. There would then be no way to convert the heat energy of the universe into useful mechanical work. He called it the 'Heat Death' of the universe. Kelvin also developed the *absolute temperature scale* (the 0°K or absolute zero temperature on this scale equals –273.15°C, or –523.67°F if one insists on measuring temperature only in degrees Fahrenheit). Kelvin was also noted for his hubris, and often fatuous remarks, however.

[47]   Carol Loomis, "Warren Buffett on the Stock Market", *Fortune Magazine* (December 10, 2000) (http://www.fortune.com/indexw.jhtml?channel=artcol.jhtml&doc_id=205324).

Incidentally, while our presentation in Exhibit 3.58 only raises the possibility of similar returns on stocks and bonds, working on the cyclicity in stock returns similar to those we have presented and discussed in Chapter 2, Michael Alexander (*Stock Cycles: Why Stocks Won't Beat Money Markets over the Next Twenty Years,* iUniverse.com, 2000) even argues for extremely poor stock market returns in the future.

[48]   If you invest a fixed dollar amount every month, or every week if you will, then you end up buying more of your target index or stock if its price is down and less of it if its price is up. This is called dollar cost averaging because, over time, you have managed to average your costs.