ESTIMATING GROWTH

The value of a firm is the present value of expected future cash flows generated by the firm. The most critical input in valuation, especially for high growth firms, is the growth rate to use to forecast future revenues and earnings. In this chapter, we consider how best to estimate these growth rates for firms, including those with low revenues and negative earnings.

There are three basic ways of estimating growth for any firm. One is to look at the growth in a firm's past earnings – its historical growth rate. While this can be a useful input when valuing stable firms, there are both dangers and limitations in using this growth rate for high growth firms. The historical growth rate can often not be estimated, and even if it can, it cannot be relied on as an estimate of expected future growth.
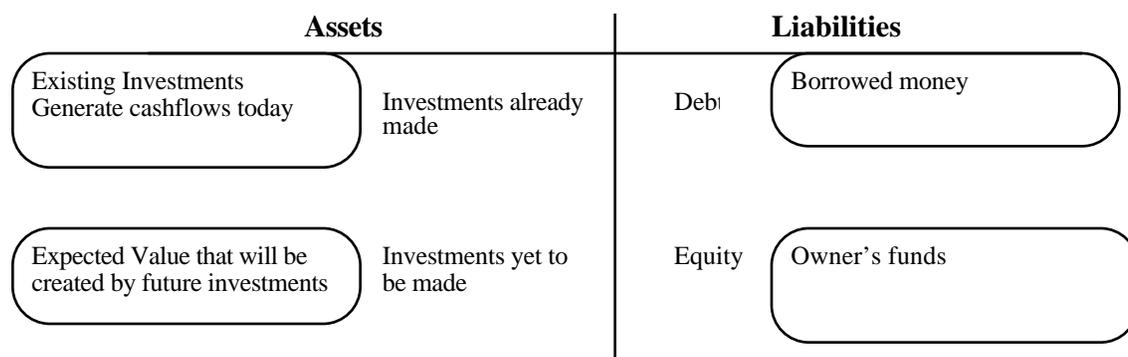
The second is to trust the equity research analysts that follow the firm to come up with the right estimate of growth for the firm and to use that growth rate in valuation. While many firms are widely followed by analysts, the quality of growth estimates, especially over longer periods, is poor. Relying on these growth estimates in a valuation can lead to erroneous and inconsistent estimates of value.

The third is to estimate the growth from a firm's fundamentals. A firm's growth ultimately is determined by how much is reinvested into new assets and the quality of these investments, with investments widely defined to include acquisitions, building up distribution channels or even expanding marketing capabilities. By estimating these inputs, you are, in a sense, estimating a firm's fundamental growth rate. While the determinants of fundamental growth remain the same for all firms, estimating these inputs for high growth firms can pose special challenges.

The Importance of Growth

A firm can be valuable because it owns assets that generate cash flows now or because it is expected to acquire such assets in the future. The first group of assets is categorized as assets in place and the second as growth assets. Figure 11.1 presents a financial balance sheet for a firm:

Figure 11.1: A Financial View of a Firm

Assets		Liabilities

| Existing Investments Generate cashflows today | Investments already made | Debt | Borrowed money |
| Expected Value that will be created by future investments | Investments yet to be made | Equity | Owner's funds |

Note that an accounting balance sheet can be very different from a financial balance sheet, since accounting for growth assets tends to be both conservative and inconsistent.

For high growth firms, accounting balance sheets do a poor job of summarizing the values of the assets of the firm because they completely ignore the largest component of value, which is future growth. The problems are exacerbated for firms that invest in research because the book value will not include the most important asset at these firms – the research asset.

Historical Growth

When estimating the expected growth for a firm, we generally begin by looking at the firm's history. How rapidly have the firm's operations as measured by revenues or earnings grown in the recent past? While past growth is not always a good indicator of future growth, it does convey information that can be valuable while making estimates for the future. In this section, we begin by looking at measurement issues that arise when estimating past growth and then consider how past growth can be used in projections.

Estimating Historical Growth

Given a firm's earnings history, estimating historical growth rates may seem like a simple exercise but there are several measurement problems that may arise. In particular, the average growth rates can be different, depending upon how the average is estimated, and whether you allow for compounding in the growth over time. Estimating growth rates can also be complicated by the presence of negative earnings in the past or in the current period.

Arithmetic versus Geometric Averages

The average growth rate can vary depending upon whether it is an arithmetic average or a geometric average. The arithmetic average is the simple average of past growth rates, while the geometric mean takes into account the compounding that occurs from period to period.

$$\text{Arithmetic Average} = \frac{\sum_{t=-n}^{t=-1} g_t}{n} \quad \text{where } g_t = \text{growth rate in year t}$$

$$\text{Geometric Average} = \left(\frac{Earnings_0}{Earnings_{-n}}\right)^{(1/n)} - 1 \quad \text{where Earnings}_{-n} = \text{earnings in n years ago}$$

The two estimates can be very different, especially for firms with volatile earnings. The geometric average is a much more accurate measure of true growth in past earnings, especially when year-to-year growth has been erratic.

In fact, the point about arithmetic and geometric growth rates also applies to revenues, though the difference between the two growth rates tend to be smaller for revenues than for earnings. For firms with volatile earnings and revenues, the caveats about using arithmetic growth carry even more weight.

Illustration 11.1: Differences between Arithmetic and Geometric Averages: Motorola

Table 11.1 reports the revenues, EBITDA, EBIT and net income for Motorola for each year from 1994 to 1999. The arithmetic and geometric average growth rates in each series are reported at the bottom of the table:

Table 11.1: Arithmetic and Geometric Average Growth Rates: Motorola

Year	Revenues	% Change	EBITDA	% Change	EBIT	% Change	Net Income	% Change
1994	$ 22,245		$ 4,151		$ 2,604		$ 1,560	
1995	$ 27,037	21.54%	$ 4,850	16.84%	$ 2,931	12.56%	$ 1,781	14.17%
1996	$ 27,973	3.46%	$ 4,268	-12.00%	$ 1,960	-33.13%	$ 1,154	-35.20%
1997	$ 29,794	6.51%	$ 4,276	0.19%	$ 1,947	-0.66%	$ 1,180	2.25%
1998	$ 29,398	-1.33%	$ 3,019	-29.40%	$ 822	-57.78%	$ 212	-82.03%

1999	$ 30,931	5.21%	$ 5,398	78.80%	$ 3,216	291.24%	$ 817	285.38%
Arithmetic Average		7.08%		10.89%		42.45%		36.91%
Geometric Average		6.82%		5.39%		4.31%		-12.13%
Standard deviation		8.61%		41.56%		141.78%		143.88%

Geometric Average = (Earnings$_{1999}$/Earnings$_{1994}$)$^{1/5}$-1

The arithmetic average growth rate is higher than the geometric average growth rate for all four items, but the difference is much larger with net income and operating income (EBIT) than it is with revenues and EBITDA. This is because the net and operating income are the most volatile of the numbers, with a standard deviation in year-to-year changes of almost 140%. Looking at the net and operating income in 1994 and 1999, it is also quite clear that the geometric averages are much better indicators of true growth. Motorola's operating income grew only marginally during the period and this is reflected in its geometric average growth rate, which is 4.31%, but not in its arithmetic average growth rate, which indicates much faster growth. Motorola's net income dropped by almost 50% during the period. This is reflected in its negative geometric average growth rate but its arithmetic average growth rate is 36.91%.

Linear and Log-linear Regression Models

The arithmetic mean weights percentage changes in earnings in each period equally and ignores compounding effects in earnings. The geometric mean considers compounding but focuses on the first and the last earnings observations in the series - it ignores the information in the intermediate observations and any trend in growth rates that may have developed over the period. These problems are at least partially overcome by using OLS[1] regressions of earnings per share (EPS) against time. The linear version of this model is:

$EPS_t = a + b \, t$

where,

EPS_t = Earnings per share in period t

t = Time period t

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[1] An ordinary least squares (OLS) regression estimates regression coefficients by minimizing the squared differences of predicted from actual values.

The slope coefficient *b* on the time variable is a measure of earnings change per time period. The problem, however, with the linear model is that it specifies growth in terms of dollar EPS and is not appropriate for projecting future growth, given compounding.

The log-linear version of this model converts the coefficient into a percentage change.

$$\ln(EPS_t) = a + b\,t$$

where,

$\ln(EPS_t)$ = Natural logarithm of Earnings per share in period t

t = Time period t

The coefficient *b* on the time variable becomes a measure of the percentage change in earnings per unit time.

Illustration 11.2: Linear and Log-linear models of growth: General Electric.

The earnings per share from 1991 to 2000 is provided for GE in Table 11.2 with the percentage changes and the natural logs of the earnings per shares computed each year.

Table 11.2: Earnings Per Share: General Electric

Year	Calendar Year	EPS	% Change in EPS	ln(EPS)
1	1991	0.42		-0.8675
2	1992	0.41	-2.38%	-0.8916
3	1993	0.4	-2.44%	-0.9163
4	1994	0.58	45.00%	-0.5447
5	1995	0.65	12.07%	-0.4308
6	1996	0.72	10.77%	-0.3285
7	1997	0.82	13.89%	-0.1985
8	1998	0.93	13.41%	-0.0726
9	1999	1.07	15.05%	0.0677
10	2000	1.27	18.69%	0.2390

There are a number of ways in which we can estimate the growth rate in earnings per share at GE between 1991 and 2000. One is to compute the arithmetic and geometric averages.

Arithmetic average growth rate in earnings per share = 13.79%

Geometric average growth rate in earnings per share = $(1.27/0.42)^{1/9}-1 = 13.08\%$

The second is to run a linear regression of earnings per share against a time variable (where the earliest year is given a value of 1, the next year a value of 2 and so on):

$$\text{Linear Regression : EPS} = \quad 0.2033 + \quad 0.0952 \text{ t} \quad R^2 = 94.5\%$$
$$(4.03) \quad\quad (11.70)$$

This regression would indicate that the earnings per share increased 9.52 cents a year from 1991 to 2000. We can convert it into a percentage growth in earnings per share by dividing this change by the average earnings per share over the period.

$$\text{Growth rate in earnings per share} =$$
$$\frac{\text{Coefficient on linear regression}}{\text{Average EPS}} = \frac{0.0952}{0.727} = 13.10\%$$

Finally, you can regress ln(EPS) against the time variable.

$$\text{Log-linear Regression: ln (EPS)} = -1.1288 \quad + 0.1335 \text{ t} \quad\quad R^2 = 96.3\%$$
$$(19.53) \quad\quad (14.34)$$

The coefficient on the time variable here can be viewed as a measure of compounded percent growth in earnings per share; GE's earnings per share grew at 13.35% a year based upon this regression.

The numbers are close using all of the approaches because there is so little variability in the growth rate of earnings per share at GE. For companies with more volatile earnings, the differences will be much larger.

Negative Earnings

Measures of historical growth are distorted by the presence of negative earnings numbers. The percentage change in earnings on a year-by-year basis is defined as:

$$\% \text{ change in EPS in period t} = \frac{EPS_t - EPS_{t-1}}{EPS_{t-1}} = \frac{EPS_t}{EPS_{t-1}} - 1$$

If EPS_{t-1} is negative or zero, this calculation yields a meaningless number. This extends into the calculation of the geometric mean. If the EPS in the initial time period is negative or zero, the geometric mean is not meaningful.

Similar problems arise in log-linear regressions, since the EPS has to be greater than zero for the log transformation to exist. There are at least two ways of trying to get meaningful estimates of earnings growth for firms with negative earnings. One is to run the linear regression of EPS against time specified in the previous regression.

$$EPS = a + b\,t$$

The growth rate can then be approximated as follows:

$$\text{Growth rate in EPS} = \frac{b}{\text{Average EPS over the time period of the regression}}$$

This assumes that the average EPS over the time period is positive. Another approach to estimating growth for these firms, suggested by Arnott, is as follows:

$$\% \text{ change in EPS} = \frac{EPS_t - EPS_{t-1}}{\text{Max}\left(EPS_t, EPS_{t-1}\right)}$$

Alternatively, you could use the absolute value of earnings per share in the previous period.

Note that these approaches to estimating historical growth rates do not provide any information on whether these growth rates are useful in predicting future growth. It is not incorrect and, in fact, it may be appropriate, to conclude that the historical growth rate is 'not meaningful' when earnings are negative and to ignore it in predicting future growth. While there are ways of estimating growth even when earnings are negative, the resulting growth rates are not very useful indicators of past growth and it is best to view the past growth as not meaningful in those cases.

Illustration 11.3: Negative Earnings: Commerce One and Aracruz Celulose

The problems with estimating earnings growth when earnings are negative can be seen even for firms that have only negative earnings. For instance, Commerce One, the B2B firm, reported operating earnings (EBIT) of -$53 million in 1999 and -$340 million in 2000. Clearly, the firm's earnings deteriorated, but estimating a standard earnings growth rate would lead us to the following growth rate:

Earnings growth for Commerce One in 2000 $= \dfrac{-340 - \left(-53\right)}{-53} = 5.41 = 541\%$

Now consider Aracruz, a Brazilian paper and pulp company, susceptible like other firms in the industry to the ebbs and flows of commodity prices. Table 11.3 reports the earnings per share at the firm from 1995 to 2000.

Table 11.3: EPS at Aracruz Celulose in Brazilian Real: 1995-2000

Year	EPS
1995	0.302
1996	0.041
1997	0.017
1998	-0.067
1999	0.065
2000	0.437

The negative net income (and earnings per share) numbers in 1998 make the estimation of a growth rate in 1999 problematic. For instance, the firm has a loss per share of 0.067 BR in 1998 and a profit per share of 0.065 BR in 1999. The growth rate in earnings per share estimated using the conventional equation, would be:

Earnings growth rate in 1999 $= \dfrac{0.065 - \left(-0.067\right)}{-0.067} = -1.97 = -197\%$

This growth rate, a negative number, makes no sense given the improvement in earnings during the year. There are two fixes to this problem. One is to replace the actual earnings per share in the denominator with the absolute value:

Earnings growth rate in 1999$_{\text{absolute value}} = \dfrac{0.065 - \left(-0.067\right)}{0.067} = 1.97 = 197\%$

The other is to use the higher of the earnings per share from the two years yielding:

Earnings growth rate in 1999$_{\text{Higher value}} = \dfrac{0.065 - \left(-0.067\right)}{0.065} = 2.03 = 203\%$

While the growth rate is now positive, as you would expect it to be, the values for the growth rates themselves are not very useful for making estimates for the future.

Time Series Models to predict Earnings per share

Time series models use the same historical information as the simpler models described in the previous section. They attempt to extract better predictions from this data, however, through the use of sophisticated statistical techniques.

Box-Jenkins Models

Box and Jenkins developed a procedure for analyzing and forecasting univariate time series data using an autoregressive integrated moving average model. AutoRegressive Integrated Moving Average (ARIMA) models a value in a time series as a linear combination of past values and past errors (shocks). Since historical data is used, these models are appropriate as long as the data does not show deterministic behavior, such as a time trend or a dependence on outside events or variables. ARIMA models are usually denoted by the notation:

ARIMA (p, d, q)

where,

p is the degree of the autoregressive part

d is the degree of differencing

q is the degree of the moving average process

The mathematical model can then be written as follows:

$$w_t = \phi_1 w_{t-1} + \phi_1 w_{t-2} + ... + \phi_p w_{t-p} + \theta_0 - \theta_1 a_{t-1} - \theta_2 a_{t-2} - ... - \theta_q a_{t-q} + \varepsilon_t$$

where,

w_t = Original data series or difference of degree d of the original data

$\phi_1, \phi_2, ..., \phi_p$ = Autoregressive parameters

θ_0 = Constant term

$\theta_1, \theta_2, ..., \theta_q$ = Moving average parameters

ε_t = Independent disturbances, random error

ARIMA models can also adjust for seasonality in the data, in which case the model is denoted by the notation.

SARIMA (p,d,q) X (p,d,q) $_{s=n}$

where,

s = Seasonal parameter of length n

Time Series Models in Earnings

Most time series models used in forecasting earnings are built around quarterly earnings per share. In a survey paper, Bathke and Lorek (1984) pointed out that three time-series models have been shown to be useful in forecasting quarterly earnings per share. All three models are seasonal autoregressive integrated moving average (SARIMA) models, since quarterly earnings per share have a strong seasonal component. The first model, developed by Foster (1977), allows for seasonality in earnings.

Model 1: SARIMA $(1,0,0)$ X $(0,1,0)_{s=4}$

$$EPS_t = \varphi_1 EPS_{t-1} + EPS_{t-4} - \varphi_1 EPS_{t-5} + \theta_0 + \varepsilon_t$$

This model was extended by Griffin and Watts to allow for a moving average parameter.

Model 2: SARIMA $(0,1,1)$ X $(0,1,1)_{s=4}$

$$EPS_t = EPS_{t-1} + EPS_{t-4} - EPS_{t-5} - \theta_1 \varepsilon_{t-1} - \varepsilon_{t-4} - \theta_1 \varepsilon_{t-5} + \varepsilon_t$$

where,

$_1$ = First-order moving average (MA(1)) parameter

= First-order seasonal moving average parameter

$_t$ = Disturbance realization at the end of quarter t

The third time series model, developed by Brown and Rozeff (1979), is similar in its use of seasonal moving average parameter.

Model 3: SARIMA $(1,0,0)$ X $(0,1,1)_{s=4}$

$$EPS_t = \phi_1 EPS_{t-1} + EPS_{t-4} - \phi_1 EPS_{t-5} + \theta_0 - \varepsilon_{t-4}$$

How good are time series models at predicting earnings?

Time series models do better than naive models (using past earnings) in predicting earnings per share in the next quarter. The forecast error, i.e., the difference between the actual earnings per share and forecasted earnings per share, from the time series models is, on average, smaller than the forecast error from naive models (such as simple averages of past growth). The superiority of the models over naive estimates declines with longer term forecasts, suggesting that the estimated time series parameters are not stationary.

Among the time series models themselves, there is no evidence that any one model is dominant, in terms of minimizing forecast error, for every firm in the sample. The gain

from using the firm-specific best models relative to using the same model for every firm is relatively small.

Limitations in using time series models in valuation

In most studies, time series models provide superior forecasts relative to naive models. There are several concerns, however, in using these models for forecasting earnings in valuation. First, time series models require a lot of data, which is why most of them are built around quarterly earnings per share. In most valuation, the focus is on predicting annual earnings per share and not on quarterly earnings. Second, even with quarterly earnings per share, the number of observations is limited for most firms to ten to fifteen years of data (forty to sixty quarters of data), leading to large estimation errors[2] in time-series model parameters and in the forecasts. Third, the superiority of earnings forecasts from time series models declines as the forecasting period is extended. Given that earnings forecasts in valuation have to be made for several years rather than a few quarters, the value of time series models may be limited. Finally, studies indicate that analyst forecasts dominate even the best time series models in forecasting earnings.

In conclusion, time series models are likely to work best for firms which have a long history of earnings and where the parameters of the models have not shifted significantly over time. For the most part, however, the cost of using these models is likely to exceed their benefits, at least in the context of valuation.

The Usefulness of Historical Growth

Is the growth rate in the past a good indicator of growth in the future? Not necessarily. In this section we consider how good historical growth is as a predictor of future growth for all firms and why the changing size and volatile businesses of many firms can undercut growth projections.

Higgledy Piggledy Growth

Past growth rates are useful in forecasting future growth, but they have considerable noise associated with them. In a study of the relationship between past

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[2] Time series models generally can be run as long as there at least thirty observations, but the estimation

growth rates and future growth rates, Little (1960) coined the term "Higgledy Piggledy Growth" because he found little evidence that firms that grew fast in one period continued to grow fast in the next period. In the process of running a series of correlations between growth rates in earnings in consecutive periods of different length, he frequently found negative correlations between growth rates in the two periods and the average correlation across the two periods was close to zero (0.02).   If past growth in earnings is not a reliable indicator of future growth at many firms, it becomes even less so at smaller firms. The growth rates at smaller firms tend to be even more volatile than growth rates at other firms in the market. The correlation between growth rates in earnings in consecutive time periods (five-year, three-year and one-year) for firms in the United States, categorized by market value, is reported in Figure 11.2.

Figure 11.3: Correlations in Earnings Growth by Market Capitalization
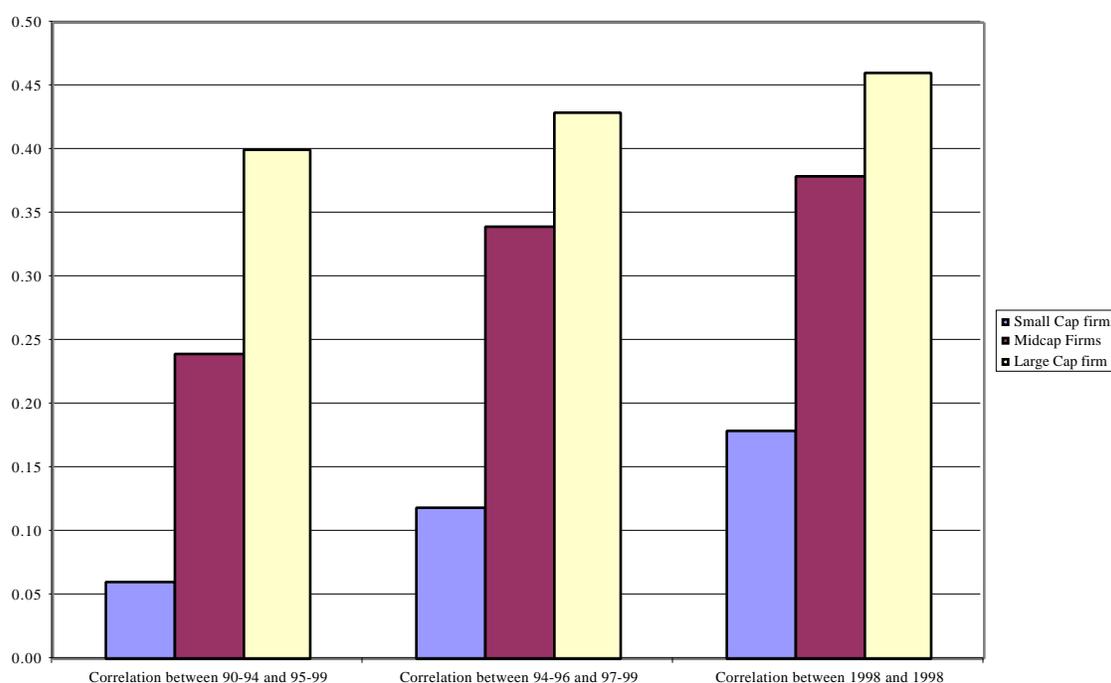
While the correlations tend to be higher across the board for one-year growth rates than for 3-year or 5-year growth rates in earnings, they are also consistently lower for smaller firms than they are for the rest of the market. This would suggest that you should be

error declines as the number of observations increases.

more cautious about using past growth, especially in earnings, for forecasting future growth at these firms.

Revenue Growth versus Earnings Growth

In general, revenue growth tends to be more persistent and predictable than earnings growth. This is because accounting choices have a far smaller effect on revenues than they do on earnings. Figure 11.4 compares the correlations in revenue and earnings growth over one-year, three-year and five-year periods at U.S. firms.

Figure 11.4: Correlation in Revenues and Earnings
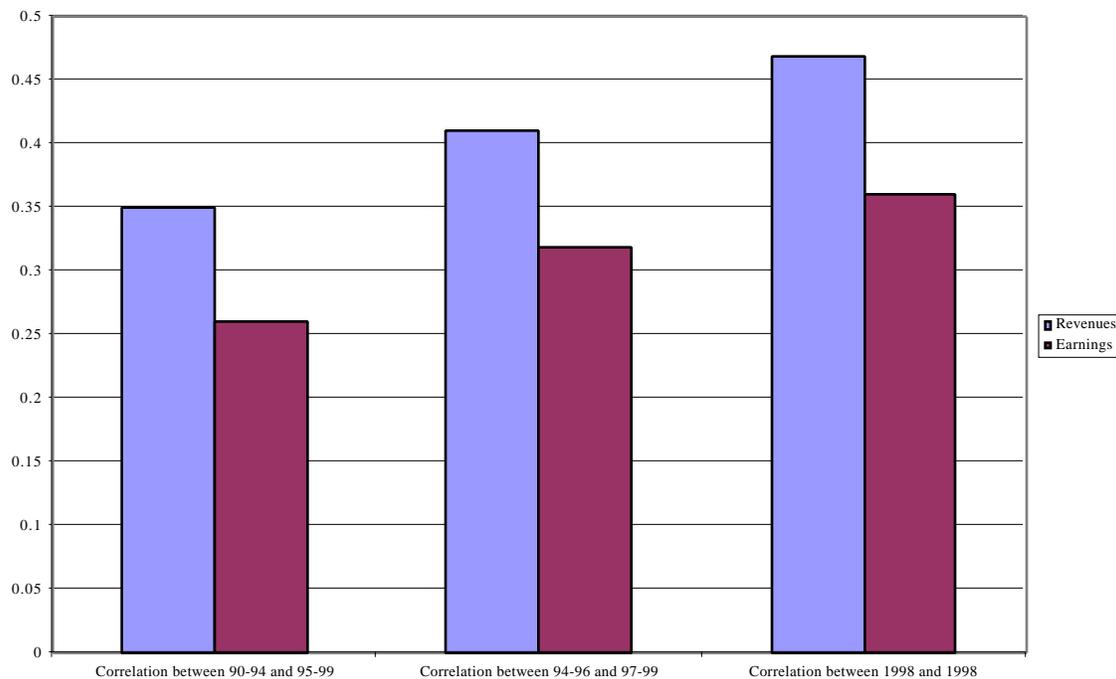
Source: Compustat

Revenue growth is consistently more correlated over time than earnings growth. The implication is that historical growth in revenues is a far more useful number when it comes to forecasting than historical growth in earnings.

The Effects of Firm Size

Since the growth rate is stated in percentage terms, the role of size has to be weighed in the analysis. It is easier for a firm with $10 million in earnings to generate a 50% growth rate than it is for a firm with $500 million in earnings to generate the same

growth. Since it becomes harder for firms to sustain high growth rates as they become larger, past growth rates for firms that have grown dramatically in size may be difficult to sustain in the future. While this is a problem for all firms, it is a particular problem when analyzing small and growing firms. While the fundamentals at these firms, in terms of management, products and underlying markets, may not have changed, it will still be difficult to maintain historical growth rates as the firms double or triple in size.

The true test for a small firm lies in how well it handles growth. Some firms, such as Cisco have been able to continue to deliver their products and services efficiently as they have grown. In other words, they have been able to scale up successfully. Other firms have had much more difficulty replicating their success as they become larger. In analyzing small firms, therefore, it is important that you look at plans to increase growth but it is even more critical that you examine the systems in place to handle this growth.

Illustration 11.4: Cisco: Earnings Growth and Size of the Firm

In Table 11.4, Cisco's evolution from a firm with revenues of $28 million and net income of $4 million in 1989 to revenues in excess of $12 billion and net income of $2.096 billion in 1999 is reported.

Table 11.4: Revenues, Operating Earnings and Net Income: Cisco

Year	Revenues	% Change	EBIT	% Change	Net Income	% Change
1989	$ 28		$ 7		$ 4	
1990	$ 70	152.28%	$ 21	216.42%	$ 14	232.54%
1991	$ 183	162.51%	$ 66	209.44%	$ 43	210.72%
1992	$ 340	85.40%	$ 129	95.48%	$ 84	95.39%
1993	$ 649	91.10%	$ 264	103.70%	$ 172	103.77%
1994	$ 1,243	91.51%	$ 488	85.20%	$ 315	83.18%
1995	$ 2,233	79.62%	$ 794	62.69%	$ 457	45.08%
1996	$ 4,096	83.46%	$ 1,416	78.31%	$ 913	99.78%
1997	$ 6,440	57.23%	$ 2,135	50.78%	$ 1,049	14.90%
1998	$ 8,488	31.80%	$ 2,704	26.65%	$ 1,355	29.17%
1999	$12,154	43.19%	$ 3,455	27.77%	$ 2,096	54.69%

Arithmetic Average =	87.81%		95.64%		96.92%
Geometric Average =	83.78%		86.57%		86.22%

While this table presents the results of a phenomenally successful decade for Cisco, it does suggest that you should be cautious about assuming that the firm will continue to grow at a similar rate in the future for two reasons. First, the growth rates have been tapering off as the firm becomes larger on all three measures. Second, if you assume that Cisco will maintain its historic growth (estimated using the geometric average) over the last decade for the next 5 years, the revenue and earnings growth that the firm will have to post will be unsustainable. For instance, if operating income grow at 86.57%% for the next 5 years, Cisco's operating income in five years will be $78 billion. Third, Cisco's growth has come primarily from acquisitions of small firms with promising technologies and using its capabilities to commercially develop these technologies. In 1999, for instance, Cisco acquired 15 firms and these acquisitions accounted for almost 80% of their reinvestment that year. If you assume that Cisco will continue to grow at historical rates, you are assuming that the number of acquisitions will also grow at the same rate. Thus, Cisco would have to acquire almost 80 firms five years from now to maintain historical growth.

Historical Growth at High Growth and Younger Firms

The presence of negative earnings, volatile growth rates over time and the rapid changes that high growth firms go through over time make historical growth rates unreliable indicators of future growth for these firms. Notwithstanding this, you can still find ways to incorporate information from historical growth into estimates of future growth, if you follow these general guidelines.

- Focus on revenue growth, rather than earnings growth, to get a measure of both the pace of growth and the momentum that can be carried forward into future years. Revenue growth is less volatile than earnings growth and is much less likely to be swayed by accounting adjustments and choices.

- Rather than look at average growth over the last few years, look at growth each year. This can provide information on how the growth is changing as the firm becomes larger and assist in making projections for the future.

- Use historical growth rates as the basis for projections only in the near future (next year or two), since technologies can change rapidly and undercut future estimates.
- Consider historical growth in the overall market and in other firms that are serving it. This information can be useful in deciding what the growth rates of the firm that you are valuing will converge over time.

histgr.xls: There is a dataset on the web that summarizes historical growth rates in earnings and revenues by industry group for the United States.

Analyst Estimates of Growth

Equity research analysts provide not only recommendations on the firms they follow but also estimates of earnings and earnings growth for the future. How useful are these estimates of expected growth from analysts and how, if at all, can they be used in valuing technology firms? In this section, you consider the process that analysts follow to estimate expected growth and follow up by examining why such growth rates may not be appropriate when valuing some firms.

Who do analysts follow?

The number of analysts tracking firms varies widely across firms. At one extreme are firms like GE, Cisco and Microsoft that are followed by dozens of analysts. At the other extreme, there are hundreds of firms that are not followed by any analysts. Figure 11.5 shows the divergence across firms in the United States, in terms of the number of analysts following them.

Figure 11.5: Number of analysts estimating earnings per shar: U.S. firms in January 2001
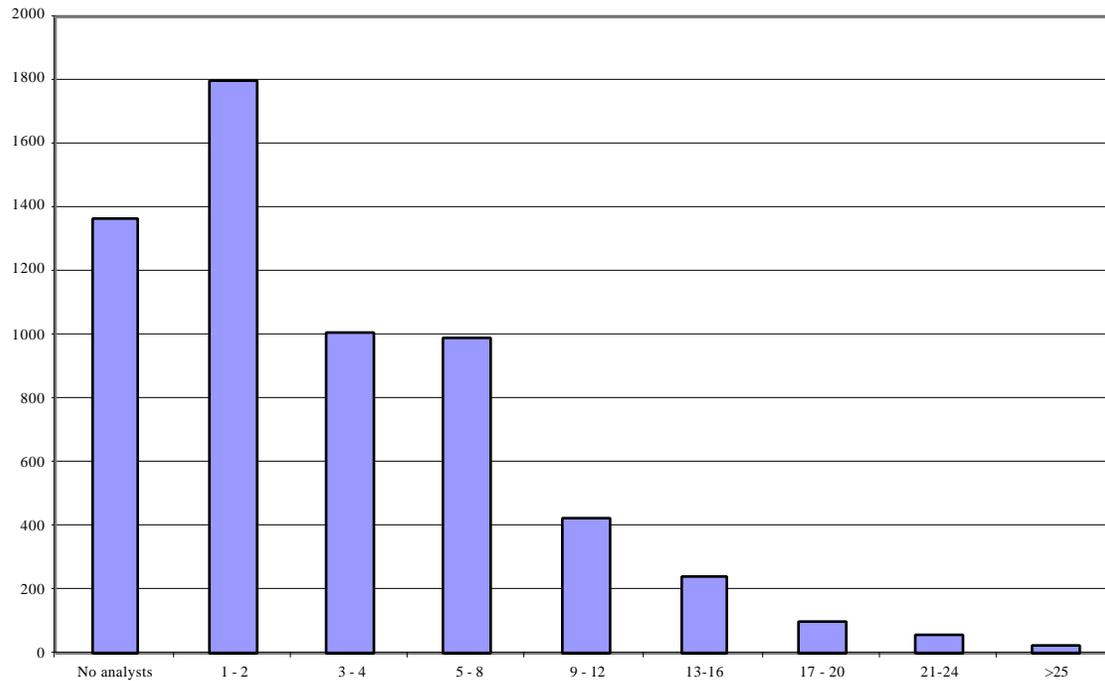
Why are some firms more heavily followed than others? These seem to be some of the determinants:

1. *Market Capitalization*: The larger the market capitalization of a firm, the more likely it is to be followed by analysts.

2. *Institutional Holding*: The greater the percent of a firm's stock that is held by institutions, the more likely it is to be followed by analysts. The open question, though, is whether analysts follow institutions or whether institutions follow analysts. Given that institutional investors are the biggest clients of equity research analysts, the causality probably runs both ways.

3. *Trading Volume*: Analysts are more likely to follow liquid stocks. Here again, though, it is worth noting that the presence of analysts and buy (or sell) recommendations on a stock may play a role in increasing trading volume.

The Information in Analyst Forecasts

There is a simple reason to believe that analyst forecasts of growth should be better than using historical growth rates. Analysts, in addition to using historical data, can avail themselves of other information that may be useful in predicting future growth.

1. Firm-specific information that has been made public since the last earnings report

Analysts can use information that has come out about the firm since the last earnings report, to make predictions about future growth. This information can sometimes lead to significant re-evaluation of the firm's expected cash flows.

2. Macro-economic information that may impact future growth

The expected growth rates of all firms are affected by economic news on GNP growth, interest rates and inflation. Analysts can update their projections of future growth as new information comes out about the overall economy and about changes in fiscal and monetary policy. Information, for instance, that shows the economy growing at a faster rate than forecast will result in analysts increasing their estimates of expected growth for cyclical firms.

3. Information revealed by competitors on future prospects

Analysts can also condition their growth estimates for a firm on information revealed by competitors on pricing policy and future growth. For instance, a negative earnings report by one telecommunications firm can lead to a reassessment of earnings for other telecommunication firms.

4. Private information about the firm

Analysts sometimes have access to private information about the firms they follow which may be relevant in forecasting future growth. This avoids answering the delicate question of when private information becomes illegal inside information. There is no doubt, however, that good private information can lead to significantly better estimates of future growth. In an attempt to restrict this type of information leakage, the SEC issued new regulations in 2000 preventing firms from selectively revealing information to a few analysts or investors. Outside the United States, however, firms routinely convey private information to analysts following them.

5. Public information other than earnings

Models for forecasting earnings that depend entirely upon past earnings data may ignore other publicly available information that is useful in forecasting future earnings. It

has been shown, for instance, that other financial variables such as earnings retention, profit margins and asset turnover are useful in predicting future growth. Analysts can incorporate information from these variables into their forecasts.

The Quality of Earnings Forecasts[3]

If firms are followed by a large number of analysts and these analysts are indeed better informed than the rest of the market, the forecasts of growth that emerge from analysts should be better than estimates based upon either historical growth or other publicly available information. But is this presumption justified? Are analyst forecasts of growth superior to other forecasts?

The general consensus from studies that have looked at short-term forecasts (one quarter ahead to four quarters ahead) of earnings is that analysts provide better forecasts of earnings than models that depend purely upon historical data. The mean relative absolute error, which measures the absolute difference between the actual earnings and the forecast for the next quarter, in percentage terms, is smaller for analyst forecasts than it is for forecasts based upon historical data. Two other studies shed further light on the value of analysts' forecasts. Crichfield, Dyckman and Lakonishok (1978) examine the relative accuracy of forecasts in the Earnings Forecaster, a publication from Standard and Poors that summarizes forecasts of earnings from more than 50 investment firms. They measure the squared forecast errors by month of the year and compute the ratio of analyst forecast error to the forecast error from time-series models of earnings. They find that the time series models actually outperform analyst forecasts from April until August, but underperform them from September through January. They hypothesize that this is because there is more firm-specific information available to analysts during the latter part of the year. The other study by O'Brien (1988) compares consensus analyst forecasts from the Institutions Brokers Estimate System (I/B/E/S) with time series forecasts from one quarter ahead to four quarters ahead. The analyst forecasts outperform the time series model for one-quarter ahead and two-quarter ahead forecasts, do as well as the time series

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[3] Sell side analysts work for brokerage houses and investment banks and their research is offered to clients of these firms as a service. In contrast, buy side analysts work for institutional investors and their research is generally proprietary.

model for three-quarter ahead forecasts and do worse than the time series model for four-quarter ahead forecasts. Thus, the advantage gained by analysts from firm-specific information seems to deteriorate as the time horizon for forecasting is extended.

In valuation, the focus is more on long term growth rates in earnings than on next quarter's earnings. There is little evidence to suggest that analysts provide superior forecasts of earnings when the forecasts are over three or five years. An early study by Cragg and Malkiel compared long term forecasts by five investment management firms in 1962 and 1963 with actual growth over the following three years to conclude that analysts were poor long term forecasters. This view is contested by Vander Weide and Carleton (1988) who find that the consensus prediction of five-year growth in the I/B/E/S is superior to historically oriented growth measures in predicting future growth. There is an intuitive basis for arguing that analyst predictions of growth rates must be better than time-series or other historical-data based models simply because they use more information. The evidence indicates, however, that this superiority in forecasting is surprisingly small for long term forecasts and that past growth rates play a significant role in determining analyst forecasts.

There is one final consideration. Analysts generally forecast earnings per share and most services report these estimates. When valuing a firm, you need forecasts of operating income and the growth in earnings per share will not be equal to the growth in operating income. In general, the growth rate in operating income should be lower than the growth rate in earnings per share. Thus, even if you decide to use analyst forecasts, you will have to adjust them down to reflect the need to forecast operating income growth.

How do you use analyst forecasts in estimating future growth?

The information in the growth rates estimated by other analysts can and should be incorporated into the estimation of expected future growth. There are several factors that determine the weight assigned to analyst forecasts in predicting future growth.

1. Amount of recent firm-specific information

Analyst forecasts have an advantage over historical-data based models because they incorporate more recent information about the firm and its future prospects. This advantage is likely to be greater for firms where there have been significant changes in

management or business conditions in the recent past, for example, a restructuring or a shift in government policy relating to the firm's underlying business.

2. Number of analysts following the stock

Generally speaking, the larger the number of analysts following a stock, the more informative is their consensus forecast and the greater should be the weight assigned to it in analysis. The informational gain from having more analysts is diminished somewhat by the well-established fact that most analysts do not act independently and that there is a high correlation across analysts' revisions of expected earnings.

3. Extent of disagreement between analysts

While consensus earnings growth rates are useful in valuation, the extent of disagreement between analysts, measured by the standard deviation in growth predictions, is also a useful measure of the reliability of the consensus forecasts. Givoly and Lakonsihok find that the dispersion of earnings is correlated with other measures of risk such as beta and is a good predictor of expected returns.

4. Quality of analysts following the stock

This is the hardest of the variables to quantify. One measure of quality is the size of the forecast error made by analysts following a stock, relative to models which use only historical data - the smaller this relative error, the larger the weight that should be attached to analyst forecasts. Another measure is the effect on stock prices of analyst revisions - the more informative the forecasts, the greater the effect on stock prices. There are some who argue that the focus on consensus forecasts misses the point that some analysts are better than others in predicting earnings and that their forecasts should be isolated from the rest and weighted more.

Analysts forecasts may be useful in coming up with a predicted growth rate for a firm but there is a danger to blindly following consensus forecasts. Analysts often make significant errors in forecasting earnings, partly because they depend upon the same data sources (which might have been erroneous or misleading) and partly because they sometimes overlook significant shifts in the fundamental characteristics of the firm. The secret to successful valuation often lies in discovering inconsistencies between analysts'

forecasts of growth and a firm's fundamentals. The next section examines this relationship in more detail.

The Fundamental Determinants of Growth

    With both historical and analyst estimates, growth is an exogenous variable that affects value but is divorced from the operating details of the firm. The soundest way of incorporating growth into value is to make it endogenous, i.e., to make it a function of how much a firm reinvests for future growth and the quality of its reinvestment. We will begin by considering the relationship between fundamentals and growth in equity income, and then move on to look at the determinants of growth in operating income.

Growth In Equity Earnings

    When estimating cash flows to equity, we usually begin with estimates of net income, if we are valuing equity in the aggregate, or earnings per share, if we are valuing equity per share. In this section, we will begin by presenting the fundamentals that determine expected growth in earnings per share and then move on to consider a more expanded version of the model that looks at growth in net income.

Growth in Earnings Per Share

    The simplest relationship determining growth is one based upon the retention ratio (percentage of earnings retained in the firm) and the return on equity on its projects. Firms that have higher retention ratios and earn higher returns on equity should have much higher growth rates in earnings per share than firms that do not share these characteristics. To establish this, note that

$$g_t = \frac{NI_t - NI_{t-1}}{NI_{t-1}}$$

where,

    g_t = Growth Rate in Net Income

    NI_t = Net Income in year t

Given the definition of return on equity, the net income in year t-1 can be written as:

    $NI_{t-1} = \text{Book Value of Equity}_{t-2} * ROE_{t-1}$

where,

ROE_{t-1} = Return on equity in year t-1

The net income in year t can be written as:

$$NI_t = (\text{Book Value of Equity}_{t-2} + \text{Retained Earnings}_{t-1})* ROE_t$$

Assuming that the return on equity is unchanged, i.e., $ROE_t = ROE_{t-1} = ROE$,

$$g_t = \frac{\text{Retained Earnings}_{t-1}}{NI_{t-1}} (ROE) = (\text{Retained Ratio})(ROE) = (b)(ROE)$$

where b is the retention ratio. Note that the firm is not being allowed to raise equity by issuing new shares. Consequently, the growth rate in net income and the growth rate in earnings per share are the same in this formulation.

Illustration 11.5: Growth in Earnings Per Share

In this illustration, we will consider the expected growth rate in earnings based upon the retention ratio and return on equity for three firms – Consolidated Edison, a regulated utility that provides power to New York City and its environs, Procter & Gamble, a leading brand-name consumer product firm and Reliance Industries, a large Indian manufacturing firm. In Table 11.5, we summarize the returns on equity, retention ratios and expected growth rates in earnings for the three firms.

Table 11.5: Fundamental Growth Rates in Earnings per Share

	Return on Equity	*Retention Ratio*	*Expected Growth Rate*
Consolidated Edison	11.63%	29.96%	3.49%
Procter & Gamble	29.37%	49.29%	14.48%
Reliance Industries	19.43%	82.57%	16.04%

Reliance has the highest expected growth rate in earnings per share, assuming that it can maintain its current return on equity and retention ratio. Procter & Gamble also can be expected to post a healthy growth rate, notwithstanding the fact that it pays out more than 50% of its earnings as dividends, because of its high return on equity. Co Ed, on the other hand, has a very low expected growth rate because its return on equity and retention ratio are anemic.

Growth in Net Income

If we relax the assumption that the only source of equity is retained earnings, the growth in net income can be different from the growth in earnings per share. Intuitively, note that a firm can grow net income significantly by issuing new equity to fund new projects while earnings per share stagnates. To derive the relationship between net income growth and fundamentals, we need a measure of how investment that goes beyond retained earnings. One way to obtain such a measure is to estimate directly how much equity the firm reinvests back into its businesses in the form of net capital expenditures and investments in working capital.

Equity reinvested in business = (Capital Expenditures – Depreciation + Change in Working Capital – (New Debt Issued – Debt Repaid))

Dividing this number by the net income gives us a much broader measure of the equity reinvestment rate:

$$\text{Equity Reinvestment Rate} = \frac{\text{Equity reinvested}}{\text{Net Income}}$$

Unlike the retention ratio, this number can be well in excess of 100% because firms can raise new equity. The expected growth in net income can then be written as:

Expected Growth in Net Income = $\left(\text{Equity Reinvestment Rate}\right)\left(\text{Return on Equity}\right)$

Illustration 11.6: Growth in Net Income

To estimate growth in operating income based upon fundamentals, we look at three firms – Coca Cola, Nestle and Sony. In Table 11.6, we first estimate the components of equity reinvestment and use it to estimate the reinvestment rate for each of the firms. We also present the return on equity and the expected growth rate in net income at each of these firms.

Table 11.6: Expected Growth in Net Income

	Net Income	*Net Cap Ex*	*Change in Working Capital*	*Net Debt Issued (paid)*	*Equity Reinvestment Rate*	*ROE*	*Expected Growth Rate*
Coca Cola	$ 2177 m	468	852	-$104.00	65.41%	23.12%	15.12%

Nestle	SFr 5763m	2470	368	272	44.53%	21.20%	9.44%
Sony	JY 30.24b	26.29	-4.1	3.96	60.28%	1.80%	1.09%

The pluses and minuses of this approach are visible in the table above. The approach much more accurately captures the true reinvestment in the firm by focusing not on what was retained but on what was reinvested. The limitation of the approach is that the ingredients that go into the reinvestment – capital expenditures, working capital change and net debt issued – are all volatile numbers. Note that Coca Cola paid off debt last year, while reinvesting back into the business and Sony's working capital dropped. In fact, it would probably be much more realistic to look at the average reinvestment rate over three or five years, rather than just the current year. We will return to examine this question in more depth when we look at growth in operating income.

Determinants of Return on Equity

Both earnings per share and net income growth are affected by the return on equity of a firm. The return on equity is affected by the leverage decisions of the firm. In the broadest terms, increasing leverage will lead to a higher return on equity if the pre-interest, after-tax return on capital exceeds the after-tax interest rate paid on debt. This is captured in the following formulation of return on equity:

$$ROE = ROC + \frac{D}{E}\left(ROC - i(1-t)\right)$$

where,

$$ROC = \frac{EBIT(1-t)}{BV \text{ of Debt} + +BV \text{ of Equity}}$$

$$\frac{D}{E} = \frac{BV \text{ of Debt}}{BV \text{ of Equity}}$$

$$i = \frac{Interest \text{ Expense on Debt}}{BV \text{ of Debt}}$$

t = Tax rate on ordinary income

The derivation is simple[4]. Using this expanded version of ROE, the growth rate can be written as:

$$g = b \left[ROC + \frac{D}{E} \left(ROC - i(1-t) \right) \right]$$

The advantage of this formulation is that it allows explicitly for changes in leverage and the consequent effects on growth.

Illustration 11.7: Breaking down Return on Equity

To consider the components of return on equity, we look, in Table 11.7, at Con Ed, Procter & Gamble and Reliance Industries, three firms whose returns on equity we looked at in Illustration 11.5.

Table 11.7: Components of Return on Equity

	ROC	Book D/E	Book Interest rate	Tax Rate	ROE
Consolidated Edison	8.76%	75.72%	7.76%	35.91%	11.63%
Procter & Gamble	17.77%	77.80%	5.95%	36.02%	28.63%
Reliance	10.24%	94.24%	8.65%	2.37%	11.94%

Comparing these numbers to those reported in Illustration 11.5, you will note that the return on equity is identical for Con Ed but significantly lower here for the other two firms. This is because both Procter & Gamble and Reliance posted significant non-operating profits. We have chosen to consider only operating income in the return on capital computation. To the extent that firms routinely report non-operating income, you could modify the return on capital.

The decomposition of return on equity for Reliance suggests a couple of areas of concern. One is that the high return on equity in Illustration 11.5 reported by the firm is

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$$ROC + \frac{D}{E} \left(ROC - i(1-t) \right) = \frac{NI + Int(1-t)}{D+E} + \frac{D}{E} \left[\frac{NI + Int(1-t)}{D+E} - \frac{Int(1-t)}{D} \right]$$

$$= \frac{NI + Int(1-t)}{D+E} \left[1 + \frac{D}{E} \right] - \frac{Int(1-t)}{E} = \frac{NI}{E} + \frac{Int(1-t)}{E} - \frac{Int(1-t)}{E} = \frac{NI}{E} = ROE$$

driven by three factors – high leverage, a significant non-operating profit and a low tax rate. If the firm loses its tax breaks and the sources of non-operating income dry up, the firm could very easily find itself with a return on capital that is lower than its book interest rate. If this occurs, leverage could bring down the return on equity of the firm.

Average and Marginal Returns

The return on equity is conventionally measured by dividing the net income in the most recent year by the book value of equity at the end of the previous year. Consequently, the return on equity measures both the quality of both older projects that have been on the books for a substantial period and new projects from more recent periods. Since older investments represent a significant portion of the earnings, the average returns may not shift substantially for larger firms that are facing a decline in returns on new investments, either because of market saturation or competition. In other words, poor returns on new projects will have a lagged effect on the measured returns. In valuation, it is the returns that firms are making on their newer investments that convey the most information about a quality of a firm's projects. To measure these returns, we could compute a marginal return on equity by dividing the change in net income in the most recent year by the change in book value of equity in the prior year:

$$\text{Marginal Return on Equity} = \frac{\text{Net Income}_t}{\text{Book Value of Equity}_{t-1}}$$

For example, Reliance Industries reported net income of Rs 24033 million in 2000 on book value of equity of Rs 123693 million in 1999, resulting in an average return on equity of 19.43%:

Average Return on Equity = 24033/123693 = 19.43%

The marginal return on equity is computed below:

Change in net income from 1999 to 2000 = 24033- 17037 = Rs 6996 million

Change in Book value of equity from 1998 to 1999 = 123693 – 104006 = Rs 19,687 million

Marginal Return on Equity = 6996/19687 = 35.54%

The Effects of Changing Return on Equity

So far in this section, we have operated on the assumption that the return on equity remains unchanged over time. If we relax this assumption, we introduce a new component to growth – the effect of changing return on equity on existing investment over time. Consider, for instance, a firm that has a book value of equity of $100 million and a return on equity of 10%. If this firm improves its return on equity to 11%, it will post an earnings growth rate of 10% even if it does not reinvest any money. This additional growth can be written as a function of the change in the return on equity.

Addition to Expected Growth Rate $= \dfrac{\text{ROE}_t - \text{ROE}_{t-1}}{\text{ROE}_{t-1}}$

where ROE_t is the return on equity in period t. This will be in addition to the fundamental growth rate computed as the product of the return on equity in period t and the retention ratio.

Total Expected Growth Rate $= (b)(\text{ROE}_t) + \dfrac{\text{ROE}_t - \text{ROE}_{t-1}}{\text{ROE}_{t-1}}$

While increasing return on equity will generate a spurt in the growth rate in the period of the improvement, a decline in the return on equity will create a more than proportional drop in the growth rate in the period of the decline.

It is worth differentiating at this point between returns on equity on new investments and returns on equity on existing investments. The additional growth that we are estimating above comes not from improving returns on new investments but by changing the return on existing investments. For lack of a better term, you could consider it "efficiency generated growth".

Illustration 11.8: Effects of Changing Return on Equity: Con Ed

In Illustration 11.5, we looked at Con Ed's expected growth rate based upon its return on equity of 11.63% and its retention ratio of 29.96%. Assume that the firm will be able to improve its overall return on equity (on both new and existing investments) to 13% next year and that the retention ratio remains at 29.96%. The expected growth rate in earnings per share next year can then be written as:

$$\left(ROE_t\right)\left(\text{Retention Ratio}\right) + \frac{ROE_t - ROE_{t-1}}{ROE_{t-1}}$$

Expected Growth rate in EPS = $= \left(0.13\right)\left(0.2996\right) + \dfrac{0.13 - 0.1163}{0.13}$

$$= 0.1443 = 14.43\%$$

After next year, the growth rate will subside to a more sustainable 3.89% (0.13*0.2996).

How would the answer be different if the improvement in return on equity were only on new investments but not on existing assets? The expected growth rate in earnings per share can then be written as:

Expected Growth rate in EPS = ROE_t* Retention Ratio= 0.13* 0.2996 = 0.0389

Thus, there is no additional growth created in this case. What if the improvement had been only on existing assets and not on new investments? Then, the expected growth rate in earnings per share can be written as:

$$\left(ROE_t\right)\left(\text{Retention Ratio}\right) + \frac{ROE_t - ROE_{t-1}}{ROE_{t-1}}$$

Expected Growth rate in EPS $== \left(0.1163\right)\left(0.2996\right) + \dfrac{0.13 - 0.1163}{0.13}$

$$= 0.1402 = 14.02\%$$

Growth in Operating Income

Just as equity income growth is determined by the equity reinvested back into the business and the return made on that equity investment, you can relate growth in operating income to total reinvestment made into the firm and the return earned on capital invested.

You will consider three separate scenarios, and examine how to estimate growth in each, in this section. The first is when a firm is earning a high return on capital that it expects to sustain over time. The second is when a firm is earning a positive return on capital that is expected to increase over time. The third is the most general scenario, where a firm expects operating margins to change over time, sometimes from negative values to positive levels.

A. Stable Return on Capital Scenario

When a firm has a stable return on capital, its expected growth in operating income is a product of the reinvestment rate, i.e., the proportion of the after-tax operating income that is invested in net capital expenditures and non-cash working capital, and the quality of these reinvestments, measured as the return on the capital invested.

Expected Growth$_{\text{EBIT}}$ = Reinvestment Rate * Return on Capital

where,

$$\text{Reinvestment Rate} = \frac{\text{Capital Expenditure - Depreciation} + \quad \text{Non - cash WC}}{\text{EBIT} \, (1 \text{ - tax rate})}$$

$$\text{Return on Capital} = \frac{\text{EBIT} \left(1 \text{ - t}\right)}{\text{Capital Invested}}$$

In making these estimates, you use the adjusted operating income and reinvestment values that you computed in Chapter 4. Both measures should be forward looking and the return on capital should represent the expected return on capital on future investments. In the rest of this section, you consider how best to estimate the reinvestment rate and the return on capital.

Reinvestment Rate

The reinvestment rate measures how much a firm is plowing back to generate future growth. The reinvestment rate is often measured using the most recent financial statements for the firm. Although this is a good place to start, it is not necessarily the best estimate of the future reinvestment rate. A firm's reinvestment rate can ebb and flow, especially in firms that invest in relatively few, large projects or acquisitions. For these firms, looking at an average reinvestment rate over time may be a better measure of the future. In addition, as firms grow and mature, their reinvestment needs (and rates) tend to decrease. For firms that have expanded significantly over the last few years, the historical reinvestment rate is likely to be higher than the expected future reinvestment rate. For these firms, industry averages for reinvestment rates may provide a better indication of the future than using numbers from the past. Finally, it is important that you continue treating R&D expenses and operating lease expenses consistently. The R&D expenses, in particular, need to be categorized as part of capital expenditures for purposes of measuring the reinvestment rate.

Return on Capital

The return on capital is often based upon the firm's return on existing investments, where the book value of capital is assumed to measure the capital invested in these investments. Implicitly, you assume that the current accounting return on capital is a good measure of the true returns earned on existing investments and that this return is a good proxy for returns that will be made on future investments. This assumption, of course, is open to question for the following reasons.

• The book value of capital might not be a good measure of the capital invested in existing investments, since it reflects the historical cost of these assets and accounting decisions on depreciation. When the book value understates the capital invested, the return on capital will be overstated; when book value overstates the capital invested, the return on capital will be understated. This problem is exacerbated if the book value of capital is not adjusted to reflect the value of the research asset or the capital value of operating leases.

• The operating income, like the book value of capital, is an accounting measure of the earnings made by a firm during a period. All the problems in using unadjusted operating income described in Chapter 4 continue to apply.

• Even if the operating income and book value of capital are measured correctly, the return on capital on existing investments may not be equal to the marginal return on capital that the firm expects to make on new investments, especially as you go further into the future.

Given these concerns, you should consider not only a firm's current return on capital, but any trends in this return as well as the industry average return on capital. If the current return on capital for a firm is significantly higher than the industry average, the forecasted return on capital should be set lower than the current return to reflect the erosion that is likely to occur as competition responds.

Finally, any firm that earns a return on capital greater than its cost of capital is earning an excess return. The excess returns are the result of a firm's competitive advantages or barriers to entry into the industry. High excess returns locked in for very long periods imply that this firm has a permanent competitive advantage.

Illustration 11.9: Measuring the Reinvestment Rate, Return on Capital and Expected Growth Rate – Embraer and Amgen

In this Illustration, we will estimate the reinvestment rate, return on capital and expected growth rate for Embraer, the Brazilian aerospace firm, and Amgen. We begin by presenting the inputs for the return on capital computation in Table 11.8.

Table 11.8: Return on Capital

	EBIT	EBIT (1-t)	BV of Debt	BV of Equity	Return on Capital
Embraer	945	716.54	1321.00	697.00	35.51%
Amgen	$1,996	$1,500	$323	$5,933	23.98%

We use the effective tax rate for computing after-tax operating income and the book value of debt and equity from the end of the prior year. For Amgen, we use the operating income and book value of equity, adjusted for the capitalization of the research asset, as described in Illustration 9.2. The after-tax returns on capital are computed in the last column.

We follow up by estimating capital expenditures, depreciation and the change in non-cash working capital from the most recent year in Table 11.9.

Table 11.9: Reinvestment Rate

	EBIT(1-t)	Capital expenditures	Depreciation	Change in Working Capital	Reinvestment	Reinvestment Rate
Embraer	716.54	182.10	150.16	-173.00	-141.06	-19.69%
Amgen	$1,500.32	$1,283.00	$610.00	$121.00	$794.00	52.92%

Here again, we treat R&D as a capital expenditure and the amortization of the research asset as part of depreciation for computing the values for Amgen. In the last column, we compute the reinvestment rate by dividing the total reinvestment (cap ex – depreciation + Change in working capital) by the after-tax operating income. Note that

Embraer's reinvestment rate is negative because of non-cash working capital dropped by 173 million in the most recent year.

Finally, we compute the expected growth rate by multiplying the after-tax return on capital by the reinvestment rate in Table 11.10

Table 11.10: Expected Growth Rate in Operating Income

	Reinvestment Rate	*Return on Capital*	*Expected Growth Rate*
Embraer	-19.69%	35.51%	-6.99%
Amgen	52.92%	23.98%	12.69%

If Amgen can maintain the return on capital and reinvestment rate that they had last year, it would be able to grow at 12.69% a year. Embraer's growth rate is negative because its reinvestment rate is negative. In the Illustration that follows, we will look at the reinvestment rate in more detail.

Illustration 11.10: Current, Historical Average and Industry Averages

The reinvestment rate is a volatile number and often shifts significantly from year to year. Consider Embraer's reinvestment rate in Table 11.11 over the last five years.

Table 11.11: Reinvestment and Reinvestment Rate: Embraer

	1996	*1997*	*1998*	*1999*	*2000*	*Total*
EBIT	75.75	91.86	230.51	588.63	945.00	
Tax rate	0.00%	0.00%	8.15%	0.00%	24.17%	
EBIT (1-t)	75.75	91.86	211.72	588.63	716.32	1684.46
Capital Expenditures	334.57	9.90	27.62	45.64	182.11	
Depreciation	52.90	60.95	100.07	127.50	150.16	
Change in Non-cash working capital	-3.00	52.00	279.00	608.00	-205.00	
Reinvestment	278.67	0.95	206.55	526.14	-173.05	839.26
Reinvestment Rate	367.88%	1.03%	97.56%	89.38%	-24.16%	49.82%

The reinvestment rate over the last 5 years has ranged from –24% in 2000 to 368% in 1996. We computed the average reinvestment rate over the five years, by dividing the total reinvestment over the 5 years by the total after-tax operating income over the last 5 years.[5]

We also computed Embraer's return on capital each year for the last 5 years in Table 11.12:

Table 11.12: Return on Capital: Embraer – 1996-2000

	1996	*1997*	*1998*	*1999*	*2000*	*Total*
EBIT(1-t)	75.75	91.86	211.72	588.63	716.50	1684.46
Book Value of Capital (Beginning)	404	578	724	1234	2018	4958
Return on Capital	18.75%	15.89%	29.24%	47.70%	35.51%	33.97%

While the return on capital also shifts significantly over time, the average return on capital of 33.97% is close to the current return on capital.

Clearly, the estimates of expected growth are a function of what you assume about future investments. For Embraer, if you assume that the current return on capital and reinvestment rate are the best indicators for the future, you would obtain a negative growth rate. If, on the other hand, you assume that the average reinvestment rate and return on capital were better measures for the future, your expected growth rate would be:

Expected Growth rate = Reinvestment Rate * Return on Capital

$$= 0.4982*0.3397 = 0.1693 \text{ or } 16.93\%$$

In the case of Embraer, we believe that this estimate is a much more reasonable one given what we know about the firm and its growth potential.

Negative Reinvestment Rates: Causes and Consequences

The reinvestment rate for a firm can be negative if its depreciation exceeds its capital expenditures or if the working capital declines substantially during the course of the year. For most firms, this negative reinvestment rate will be a temporary phenomenon

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[5] This tends to work better than averaging the reinvestment rate over 5 years. The reinvestment rate tends to be much more volatile than the dollar values.

reflecting lumpy capital expenditures or volatile working capital. For these firms, the current year's reinvestment rate (which is negative) can be replaced with an average reinvestment rate over the last few years. (This is what we did for Embraer in the Illustration above.) For some firms, though, the negative reinvestment rate may be a reflection of the policies of the firms and how we deal with it will depend upon why the firm is embarking on this path:

- Firms that have over invested in capital equipment or working capital in the past may be able to live off past investment for a number of years, reinvesting little and generating higher cash flows for that period. If this is the case, we should not use the negative reinvestment rate in forecasts and estimate growth based upon improvements in return on capital. Once the firm has reached the point where it is efficiently using its resources, though, we should change the reinvestment rate to reflect industry averages.

- The more extreme scenario is a firm that has decided to liquidate itself over time, by not replacing assets as they become run down and by drawing down working capital. In this case, the expected growth should be estimated using the negative reinvestment rate. Not surprisingly, this will lead to a negative expected growth rate and declining earnings over time.

fundgrEB.xls: There is a dataset on the web that summarizes reinvestment rates and return on capital by industry group in the United States for the most recent quarter.

B. Positive and Changing Return on Capital Scenario

The analysis in the previous section is based upon the assumption that the return on capital remains stable over time. If the return on capital changes over time, the expected growth rate for the firm will have a second component, which will increase the growth rate if the return on capital increases and decrease the growth rate if the return on capital decreases.

$$\text{Expected Growth Rate} \ = \ \left(\text{ROC}_t\right)\left(\text{Reinvestment rate}\right) + \frac{\text{ROC}_t - \text{ROC}_{t-1}}{\text{ROC}_t}$$

For example, a firm that sees its return on capital improves from 10% to 11% while maintaining a reinvestment rate of 40% will have an expected growth rate of:

$$\text{Expected Growth Rate} = (0.11)(0.40) + \frac{0.11 - 0.10}{0.10} = 14.40\%$$

In effect, the improvement in the return on capital increases the earnings on existing assets and this improvement translates into an additional growth of 10% for the firm.

Marginal and Average Returns on Capital

So far, you have looked at the return on capital as the measure that determines return. In reality, however, there are two measures of returns on capital. One is the return earned by firm collectively on all of its investments, which you define as the average return on capital. The other is the return earned by a firm on just the new investments it makes in a year, which is the marginal return on capital.

Changes in the marginal return on capital do not create a second-order effect and the value of the firm is a product of the marginal return on capital and the reinvestment rate. Changes in the average return on capital, however, will result in the additional impact on growth chronicled above.

Candidates for Changing Average Return on Capital

What types of firms are likely to see their return on capital change over time? One category would include firms with poor returns on capital that improve their operating efficiency and margins, and consequently their return on capital. In these firms, the expected growth rate will be much higher than the product of the reinvestment rate and the return on capital. In fact, since the return on capital on these firms is usually low before the turn-around, small changes in the return on capital translate into big changes in the growth rate. Thus, an increase in the return on capital on existing assets of 1% to 2% doubles the earnings (resulting in a growth rate of 100%).

The other category would include firms that have very high returns on capital on their existing investments but are likely to see these returns slip as competition enters the business, not only on new investments but also on existing investments.

Illustration 11.12: Estimating Expected Growth with Changing Return on Capital: Titan Cement and Motorola

In 2000, Titan Cement, a Greek cement company, reported operating income of 55,467 million drachmas on capital invested of 135,376 million drachmas. Using its effective tax rate of 24.5%, we estimate a return on capital for the firm of 30.94%:

$$\text{Return on Capital} = \frac{55{,}467(1 - 0.245)}{135{,}376} = 30.94\%$$

Assume that the firm will see its return on capital drop on both its existing assets and its new investments to 29% next year and that its reinvestment rate will stay at 35%. The expected growth rate next year can be estimated.

$$\text{Expected growth rate} = (0.29)(0.35) + \frac{0.29 - 0.3094}{0.3094} = 3.88\%$$

In contrast, consider Motorola. The firm had a reinvestment rate of 52.99% and a return on capital of 12.18% in 1999. Assume that Motorola's return on capital will increase towards the industry average of 22.27%, as the firm sheds the residue of its ill-fated Iridium investment and returns to its roots. Assume that Motorola's return on capital will increase from 12.18% to 17.22% over the next 5 years[6]. For simplicity, also assume that the change occurs linearly over the next 5 years. The expected growth rate in operating income each year for the next 5 years can then be estimated.[7]

Expected Growth Rate

$$= (\text{ROC}_{current})(\text{Reinvestment Rate}_{current}) + \left[1 + \frac{\text{ROC}_{in\ 5\ years} - \text{ROC}_{current}}{\text{ROC}_{current}}\right]^{\frac{1}{5}} - 1$$

$$= (0.1218)(0.5299) + \left[1 + \frac{0.1722 - 0.1218}{0.1218}\right]^{\frac{1}{5}} - 1$$

$$= 0.1363 = 13.63\%$$

The improvement in return on capital over the next five years will result in a higher growth rate in operating earnings at Motorola over that period.

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[6] 17.22% is exactly halfway between the current return on capital and the industry average of 22.27%.
[7] You are allowing for a compounded growth rate over time. Thus, if earnings are expected to grow 25% over three years, you estimate the expected growth rate each year to be:
Expected Growth Rate each year = $(1.25)^{1/3} - 1 = 0.0772$.

chgrowth.xls: This spreadsheet allows you to estimate the expected growth rate in operating income for a firm where the return on capital is expected to change over time.

C. Negative Return on Capital Scenario

The third and most difficult scenario for estimating growth is when a firm is losing money and has a negative return on capital. Since the firm is losing money, the reinvestment rate is also likely to be negative. To estimate growth in these firms, you have to move up the income statement and first project growth in revenues. Next, you use the firm's expected operating margin in future years to estimate the operating income in those years. If the expected margin in future years is positive, the expected operating income will also turn positive, allowing us to apply traditional valuation approaches in valuing these firms. You also estimate how much the firm has to reinvest to generate revenue growth, by linking revenues to the capital invested in the firm.

Growth in Revenues

Many high growth firms, while reporting losses, also show large increases in revenues from period to period. The first step in forecasting cash flows is forecasting revenues in future years, usually by forecasting a growth rate in revenues each period. In making these estimates, there are five points to keep in mind.

- The rate of growth in revenues will decrease as the firm's revenues increase. Thus, a ten-fold increase in revenues is entirely feasible for a firm with revenues of $2 million but unlikely for a firm with revenues of $2 billion.

- Compounded growth rates in revenues over time can seem low, but appearances are deceptive. A compounded growth rate in revenues of 40% over ten years will result in a 40-fold increase in revenues over the period.

- While growth rates in revenues may be the mechanism that you use to forecast future revenues, you do have to keep track of the dollar revenues to ensure that they are reasonable, given the size of the overall market that the firm operates in. If the projected revenues for a firm ten years out would give it a 90% or 100% share (or greater) of the overall market in a competitive market place, you clearly should reassess the revenue growth rate.

- Assumptions about revenue growth and operating margins have to be internally consistent. Firms can post higher growth rates in revenues by adopting more aggressive pricing strategies but the higher revenue growth will then be accompanied by lower margins.
- In coming up with an estimate of revenue growth, you have to make a number of subjective judgments about the nature of competition, the capacity of the firm that you are valuing to handle the revenue growth and the marketing capabilities of the firm.

Illustration 11.12: Estimating Revenues at Commerce One

In earlier Illustrations, we had considered Commerce One, the B2B pioneer. In Table 11.13, we forecast revenues for the firm for the next 10 years, as well as for Ashford.com, an online jewelry and brand-name product retailer.

Table 11.13: Revenue Growth Rates and Revenues: Commerce One

	Commerce One		Ashford.com	
	Expected Growth		Expected Growth	
Year	Rate	Revenues	Rate	Revenues
Current		$402		$ 70.00
1	50.00%	$603	80.00%	$126.00
2	100.00%	$1,205	60.00%	$201.60
3	80.00%	$2,170	40.00%	$282.24
4	60.00%	$3,472	30.00%	$366.91
5	40.00%	$4,860	20.00%	$440.29
6	35.00%	$6,561	17.00%	$515.14
7	30.00%	$8,530	14.00%	$587.26
8	20.00%	$10,236	11.00%	$651.86
9	10.00%	$11,259	8.00%	$704.01
10	5.00%	$11,822	5.00%	$739.21

We based our estimates of growth for the firms in the initial years on the growth in revenues over the last year – we did lower the growth rate for Commerce One in the

first year because of the fact that the economy was weak at the time of the valuation and business spending had slowed.

As a check, we also examined how much the revenues at each of these firms would be in ten years relative to more mature companies in the sector now.

- We compared revenues at Commerce One in ten years to those of EDS – a leading provider of business services- today. EDS had revenues of $18.73 billion in 1999, which would make Commerce One a leading player in this sector but not by an overwhelming margin.

- Zale, which is the largest retailer of jewelry in the United States, had revenues of about $1.7 billion in 2000. Our projected growth rate for Ashford would give it revenues of $739 million.

Operating Margin Forecasts

Before considering how best to estimate the operating margins, let us begin with an assessment of where many high growth firms, early in the life cycle, stand when the valuation begins. They usually have low revenues and negative operating margins. If revenue growth translates low revenues into high revenues and operating margins stay negative, these firms will not only be worth nothing but are unlikely to survive. For firms to be valuable, the higher revenues eventually have to deliver positive earnings. In a valuation model, this translates into positive operating margins in the future. A key input in valuing a high growth firm then is the operating margin you would expect it to have as it matures.

In estimating this margin, you should begin by looking at the business that the firm is in. While many new firms claim to be pioneers in their businesses and some believe that they have no competitors, it is more likely that they are the first to find a new way of delivering a product or service that was delivered through other channels before. Thus, Amazon might have been one of the first firms to sell books online, but Barnes and Noble and Borders preceded them as book retailers. In fact, one can consider online retailers as logical successors to catalog retailers such as L.L. Bean or Lillian Vernon. Similarly, Yahoo! might have been one of the first (and most successful) internet portals but they are following the lead of newspapers that have used content and features to attract readers

and used their readership to attract advertising. Using the average operating margin of competitors in the business may strike some as conservative. After all, they would point out, Amazon can hold less inventory than Borders and does not have the burden of carrying the operating leases that Barnes and Noble does (on its stores) and should, therefore, be more efficient about generating its revenues and subsequently earnings. This may be true but it is unlikely that the operating margins for internet retailers can be persistently higher than their brick-and-mortar counterparts. If they were, you would expect to see a migration of traditional retailers to online retailing and increased competition among online retailers on price and products driving the margin down.

While the margin for the business in which a firm operates provides a target value, there are still two other estimation issues that you need to confront. Given that the operating margins in the early stages of the life cycle are negative, you first have to consider how the margin will improve from current levels to the target values. Generally, the improvements in margins will be greatest in the earlier years (at least in percentage terms) and then taper off as the firm approaches maturity. The second issue is one that arises when talking about revenue growth. Firms may be able to post higher revenue growth with lower margins but the trade off has to be considered. While firms generally want both higher revenue growth and higher margin, the margin and revenue growth assumptions have to be consistent.

Illustration 11.13: Estimating Operating Margins

To estimate the operating margins for Commerce One, we begin by estimating the operating margins of other firms in the business services/software sector. In 2000, the average pre-tax operating margin for firms in this business was 16.36%. For Ashford.com, we will use the average pre-tax operating margin of jewelry and brand name product retailers, which is 10.86%.

We will assume that both Commerce One and Ashford.com will move toward their target margins, with greater marginal improvements[8] in the earlier years and smaller

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[8] The margin each year is computed as follows:
(Margin this year + Target margin)/2

ones in the later years. Table 11.14 summarizes the expected operating margins over time for both firms.

Table 11.14: Expected Operating Margins

Year	Commerce One: Margin	Ashford.com: Operating Margin
Current	-84.62%	-228.57%
1	-34.13%	-119.74%
2	-8.88%	-60.38%
3	3.74%	-28.00%
4	10.05%	-10.33%
5	13.20%	-0.70%
6	14.78%	4.55%
7	15.57%	7.42%
8	15.97%	8.98%
9	16.16%	9.84%
10	16.26%	10.30%
11	16.36%	10.86%

Since we estimated revenue growth in the last section and the margins in this one, we can now estimate the pre-tax operating income at each of the firms over the next 10 years in Table 11.15.

Table 11.15: Expected Operating Income

Year	Commerce One			Ashford.com		
	Revenues	Operating Margin	EBIT	Revenues	Operating Margin	EBIT
Current	$402	-84.62%	-$340	$70.00	-228.57%	-$160.00
1	$603	-34.13%	-$206	$126.00	-119.74%	-$150.87
2	$1,205	-8.88%	-$107	$201.60	-60.38%	-$121.72
3	$2,170	3.74%	$81	$282.24	-28.00%	-$79.02
4	$3,472	10.05%	$349	$366.91	-10.33%	-$37.92

5	$4,860	13.20%	$642	$440.29	-0.70%	-$3.08
6	$6,561	14.78%	$970	$515.14	4.55%	$23.46
7	$8,530	15.57%	$1,328	$587.26	7.42%	$43.58
8	$10,236	15.97%	$1,634	$651.86	8.98%	$58.56
9	$11,259	16.16%	$1,820	$704.01	9.84%	$69.25
10	$11,822	16.26%	$1,922	$739.21	10.30%	$76.15

As the margins move towards target levels and revenues grow, the operating income at each of the three firms also increases.

Market Size, Market Share and Revenue Growth

Estimating revenue growth rates for a young firm in a new business may seem like an exercise in futility. While it is difficult to do, there are ways in which you can make the process easier.

- One is to work backwards by first considering the share of the overall market that you expect your firm to have once it matures and then determining the growth rate you would need to arrive at this market share. For instance, assume that you are analyzing an online toy retailer with $100 million in revenues currently. Assume also that the entire toy retail market had revenues of $70 billion last year. Assuming a 3% growth rate in this market over the next 10 years and a market share of 5% for your firm, you would arrive at expected revenues of $4.703 billion for the firm in ten years and a compounded revenue growth rate of 46.98%.

Expected Revenues in 10 years = $70 billion $* 1.03^{10} * 0.05 =$ $4.703 billion

Expected compounded growth rate = $(4,703/100)^{1/10} - 1 = 0.4698$

- The other approach is to forecast the expected growth rate in revenues over the next 3 to 5 years based upon past growth rates. Once you estimate revenues in year 3 or 5, you can then forecast a growth rate based upon companies with similar revenues growth currently. For instance, assume that the online toy retailer analyzed above had revenue growth of 200% last year (revenues went from $33 million to $100 million). You could forecast growth rates of 120%, 100%, 80% and 60% for the next 4 years, leading to revenues of $1.267 billion in four years. You could then look at the average

growth rate posted by retail firms with revenues between $1 and $1.5 billion last year and use that as the growth rate commencing in year 5.

Sales to Capital Ratio

High revenue growth is clearly a desirable objective, especially when linked with positive operating margins in future years. Firms do, however, have to invest to generate both revenue growth and positive operating margins in future years. This investment can take traditional forms (plant and equipment) but it should also include acquisitions of other firms, partnerships, investments in distribution and marketing capabilities and research and development.

To link revenue growth with reinvestment needs, you look at the revenues that every dollar of capital that you invest generates. This ratio, called the sales to capital ratio, allows us to estimate how much additional investment the firm has to make to generate the projected revenue growth. This investment can be in internal projects, acquisitions or working capital. To estimate the reinvestment needs in any year, you divide the revenue growth that you have projected (in dollar terms) by the sales to capital ratio. Thus, if you expect revenues to grow by $1 billion and you use a sales to capital ratio of 2.5, you would estimate a reinvestment need for this firm of $400 million ($1 billion/2.5). Lower sales to capital ratios increase reinvestment needs (and reduce cash flows) while higher sales to capital ratios decrease reinvestment needs (and increase cash flows).

To estimate the sales to capital ratio, you look at both a firm's past and the business it operates in. To measure this ratio historically, you look at changes in revenue each year and divide it by the reinvestment made that year. You also look at the average ratio of sales to book capital invested in the business in which the firm operates.

Linking operating margins to reinvestment needs is much more difficult to do, since a firm's capacity to earn operating income and sustain high returns comes from the competitive advantages that it acquires, partly through internal investment and partly through acquisitions. Firms that adopt a two-track strategy in investing, where one track focuses on generating higher revenues and the other on building up competitive strengths

should have higher operating margins and values than firms that concentrate only on revenue growth.

Link to Return on Capital

One of the dangers that you face when using a sales-to-capital ratio to generate reinvestment needs is that you might under-estimate or over-estimate your reinvestment needs. You can keep tabs on whether this is happening and correct it when it does by also estimating the after-tax return on capital on the firm each year through the analysis. To estimate the return on capital in a future year, you use the estimated after-tax operating income in that year and divide it by the total capital invested in that firm in that year. The former number comes from your estimates of revenue growth and operating margins, while the latter can be estimated by aggregating the reinvestments made by the firm all the way through the future year. For instance, a firm that has $500 million in capital invested today and is required to reinvest $300 million next year and $400 million the year after will have capital invested of $1.2 billion at the end of the second year.

For firms losing money today, the return on capital will be a negative number when the estimation begins but improve as margins improve. If the sales-to-capital ratio is set too high, the return-on-capital in the later years will be too high, while if it is set too low, it will be too low. Too low or high relative to what, you ask? There are two comparisons that are worth making. The first is to the average return-on-capital for mature firms in the business in which your firm operates – mature specialty and brand name retailers, in the case of Ashford.com. The second is to the firm's own cost of capital. A projected return on capital of 40% for a firm with a cost of capital of 10% in a sector where returns on capital hover around 15% is an indicator that the firm is investing too little for the projected revenue growth and operating margins. Decreasing the sales to capital ratio until the return on capital converges on 15% would be prudent.

Illustration 11.14: Estimated Sales to Capital Ratios

To estimate how much Commerce One and Ashford.com have to invest to generate the expected revenue growth, we estimate the current sales to capital ratio, the marginal sales to capital ratio in the last year and the average sales to capital ratio for the businesses that each operates in.

Table 11.16: Sales to Capital Ratio Estimates

	Commerce One	Ashford.com
Firm's Sales to Capital	3.13	1.18
Marginal Sales to Capital: Most recent year	2.70	1.60
Industry average Sales to Capital	3.18	3.24
Sales to Capital Ratio used in valuation	2.00	2.50

We used a sales to capital ratio of 2.50 for Ashford.com, approximately midway through their marginal sales to capital ratio from last year and the industry average. For Commerce One, we set the sales to capital ratio well below the industry average and the firm's marginal sales to capital ratio. We feel that as competition increases, Commerce One will have to invest increasing amounts in technology and in acquisitions to grow.

Based upon these estimates of the sales to capital ratio for each firm, we can now estimate how much each firm will have to reinvest each year for the next 10 years in Table 11.17.

Table 11.17: Estimated Reinvestment Needs

	Commerce One		*Ashford.com*	
Year	*Increase in Revenue*	*Reinvestment*	*Increase in Revenue*	*Reinvestment*
1	$201	$100	$56	$22
2	$603	$301	$76	$30
3	$964	$482	$81	$32
4	$1,302	$651	$85	$34
5	$1,389	$694	$73	$29
6	$1,701	$851	$75	$30
7	$1,968	$984	$72	$29
8	$1,706	$853	$65	$26
9	$1,024	$512	$52	$21
10	$563	$281	$35	$14

As a final check, we estimate the return on capital each year for the next 10 years for both firms in Table 11.18.

Table 11.18: Estimated Return on Capital

Year	Commerce One	Ashford.com
1	-160.23%	-254.67%
2	-46.80%	-149.09%
3	15.30%	-70.62%
4	34.46%	-26.31%
5	32.17%	-1.73%
6	26.74%	11.31%
7	26.91%	18.36%
8	25.34%	22.00%
9	23.44%	23.72%
10	22.49%	24.34%
Industry average	20.00%	20.00%

The returns-on-capital at both firms converge to sustainable levels, at least relative to industry averages, by the terminal year. This suggests that our estimates of sales to capital ratios are reasonable.

margins.xls: This dataset on the web summarizes operating margins, by industry, for the United States.

The Qualitative Aspects of Growth

The emphasis on quantitative elements – return on capital and reinvestment rates for profitable firms and margins, revenue growth and sales to capital ratios for unprofitable firms – may strike some as skewed. After all, growth is determined by a number of subjective factors – the quality of management, the strength of a firm's marketing, its capacity to form partnerships with other firms and the management's

strategic vision, among many others. Where, you might ask, is there room in the growth equations that have been presented in this chapter for these factors?

The answer is that qualitative factors matter and that they all ultimately have to show up in one or more of the quantitative inputs that determine growth. Consider the following:

- The quality of management plays a significant role in the returns on capital that you assume firms can earn on their new investments and in how long they can sustain these returns. Thus, the fact that a firm has a well-regarded management team may be one reason why you allow a firm's return on capital to remain well above the cost of capital.

- The marketing strengths of a firm and its choice of marketing strategy are reflected in the operating margins and turnover ratios that you assume for firms. Thus, it takes faith in Coca Cola's capacity to market its products effectively to assume a high turnover ratio and a high target margin. In fact, you can consider various marketing strategies, which trade off lower margins for higher turnover ratios, and consider the implications for value. The brand name of a firm's products and the strength of its distribution system also affect these estimates.

- Defining reinvestment broadly to include acquisitions, research and development and investments in marketing and distribution allows you to consider different ways in which firms can grow. For some firms like Cisco, reinvestment and growth come from acquisitions, while for other firms such as GE, it may take the form of more traditional investments in plant and equity. The effectiveness of these reinvestment strategies is captured in the return on capital that you assume for the future, with more effective firms having higher returns on capital.

- The strength of the competition that firms face is in the background but it does determine how high excess returns (return on capital – cost of capital) will be, and how quickly they will slide.

Thus, every qualitative factor is quantified and the corresponding growth implications are considered. What if you cannot quantify the effects? If you cannot, you should remain skeptical about whether these factors truly affect value. What about those qualitative

factors that do not affect the return on capital, margin or reinvestment rate? At the risk of sounding dogmatic, these factors cannot affect value.

Why is it necessary to impose this quantitative structure on growth estimate? One of the biggest dangers in valuing technology firms is that story telling can be used to justify growth rates that are neither reasonable nor sustainable. Thus, you might be told that Ashford.com will grow at 60% a year because the online retailing market is huge and that Coca Cola will grow 20% a year because it has a great brand name. While there is some truth in these stories, a consideration of how these qualitative views translate into the quantitative elements of growth is an essential step towards consistent valuations.

Can different investors consider the same qualitative factors and come to different conclusions about the implications for returns on capital, margins, reinvestment rates, and, consequently, growth? Absolutely. In fact, you would expect differences in opinion about the future and different estimates of value. The payoff to knowing a firm and the sector it operates better than other investors is that your estimates of growth and value will be better than theirs. Unfortunately, this does not guarantee that your investment returns will be better than theirs.

Summary

Growth is the key input in every valuation and there are three sources for growth rates. One is the past, though both estimating and using historical growth rates can be difficult for most firms with their volatile and sometimes negative earnings. The second is analyst estimates of growth. Though analysts may be privy to information that is not available to the rest of the market, this information does not result in growth rates that are superior to historical growth estimates. Furthermore, the analyst emphasis on earnings per share growth can be a problem when forecasting operating income. The third and soundest way of estimating growth is to base it on a firm's fundamentals.

The relationship of growth to fundamentals will depend upon what growth rate we are estimating. To estimate growth in earnings per share, we looked at return on equity and retention ratios. To estimate growth in net income, we replaced the retention ratio with the equity reinvestment rate. To evaluate growth in operating income, we used return on capital and reinvestment rate. While the details vary from approach to

approach, there are some common themes that emerge from these approaches. The first is that growth and reinvestment are linked and estimates of one have to be lined with estimates of the other. Firms that want to grow at high rates over long periods have to reinvest to create that growth. The second is that the quality of growth can vary widely across firms and that the best measure of the quality of growth is the returns earned on investments. Firms that earn higher returns on equity and capital will not only generate higher growth but that growth will add more to their value.

Problems

1. Walgreen Company reported the following earnings per share from 1989 to 1994.

Year	EPS
1989	$1.28
1990	$1.42
1991	$1.58
1992	$1.78
1993	$1.98
1994	$2.30

a. Estimate the arithmetic average and geometric average growth rate in earnings per share between 1989 and 1994. Why are they different? Which is more reliable?

b. Estimate the growth rate using a linear growth model.

c. Estimate the growth rate using a log-linear growth model.

2. Cobra Electronics reported the following earnings per share from 1989 to 1994.

Year	1989	1990	1991	1992	1993	1994
EPS	$0.77	-$0.26	-$0.90	-$1.39	-$0.65	$0.10

Estimate a historical growth rate in earnings for Cobra Electronics.

3. BIC Corporation reported a return on equity of 20% in 1994 and paid out 37% of its earnings as dividends in that year. Assuming that these fundamentals do not change, estimate the expected growth rate in earnings per share. How sensitive is this growth rate to changes in these fundamentals?

4. Gillette Company reported earnings before interest and taxes of $1,488 million in 1994, on debt (in book value) of $1,330 million and equity (in book value) of $1,790 million. Gillette had interest expenses that amounted to $90 million in that year and paid out 30% of its earnings as dividends. Allowing for a 40% tax rate,

    a. estimate the expected growth rate in earnings per share from fundamentals.

    b. estimate how much the growth rate would change if it doubled its debt (assume that the interest rate on debt will increase by 1%).

If you were valuing Gillette and you anticipated that the firm would become stable after 10 years, would you expect these fundamentals to change over time?

5. B.A.T. Industries had a pre-tax operating margin of 10% on revenues of $34,500 million in 1994 and reported a capital turnover ratio of 3.0 in that year.

     a. If the tax rate is 36%, estimate the return on capital for B.A.T. Industries.

     b. If the pre-tax operating margin drops to 8% of revenues and the asset turnover ratio remains unchanged, estimate the new return on capital.