CHAPTER 5

LOOKING FORWARD: 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, you consider how best to estimate these growth rates for technology firms, especially 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, especially technology 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 technology 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 technology firms can pose special challenges. Where, you might ask, are the subjective elements that go into estimating growth: the quality of management, changing market dynamics, the possibility that firms may change their business mixes? In a sense,

they are everywhere. When you estimate expected future margins and returns, any views that you might have about how a firm is likely to change in the future should find its way into these estimates.

The Importance of Growth

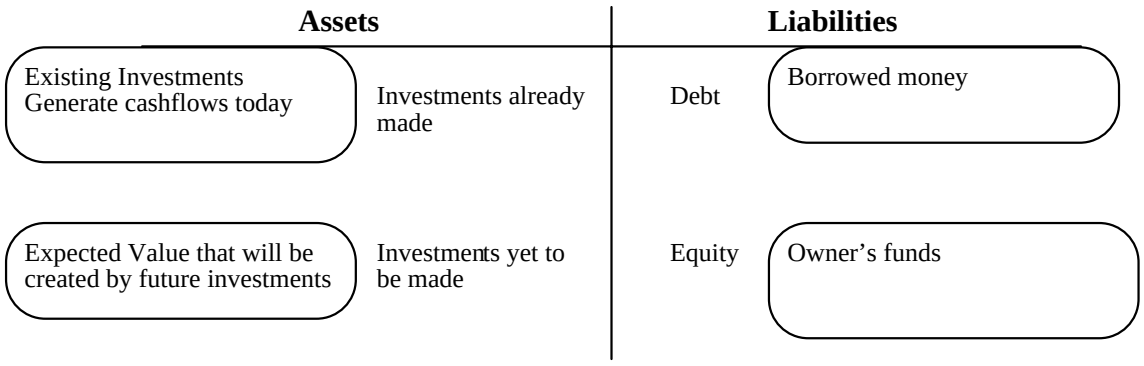
While growth is a critical component of value in all valuations, it represents a large portion of value at technology firms and almost all of the value at the new technology firms. In fact, this is the reason why many investors and private equity investors are attracted to them in the first place. Thus, growth is both the calling card and the primary determinant of value at technology firms.

In this section, the value of a firm is presented as the sum of the values of its existing investments and its expected growth potential. You then look at a series of statistics that measure the importance of growth assets at technology firms.

Growth Assets and Assets in Place

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 are categorized as assets in place and the second as growth assets. Figure 5.1 presents a financial balance sheet for a firm:

Figure 5.1: A Financial View of a Firm



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.

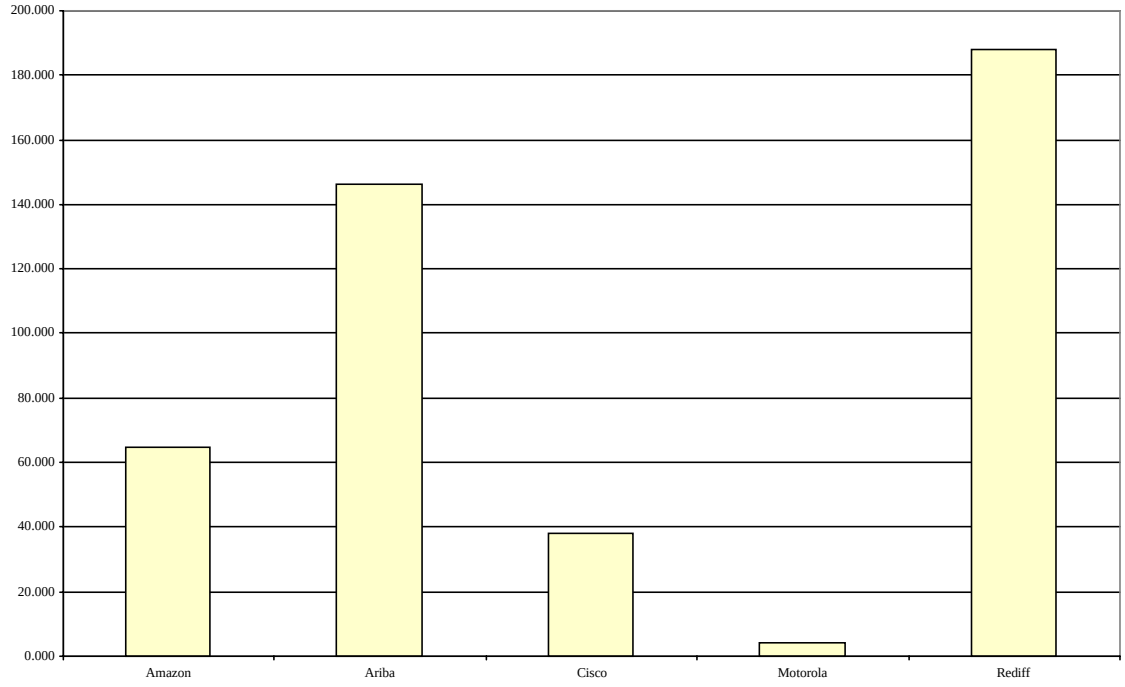
For technology firms, accounting balance sheets do a poor job of summarizing the values of the assets of the firm. They completely ignore the largest component of value, which is future growth, and do not measure the value of assets-in-place well because R&D expenses are not treated as capital expenses.

Growth Assets at Technology Firms

For firms like Cisco, a large proportion of the value comes from growth assets. These growth assets can include new projects or investments on the part of the firm, or, as is the case with Cisco, acquisitions of other firms. For firms like Rediff.com, almost all of the value is from growth assets. Thus, while growth is a critical input in most valuations, it should receive an even greater emphasis when you look at technology firms.

There are number of measures that you can use to illustrate how much more important growth assets are to technology firms than they are to other firms. One is to compare the market value of the firm, which is the market measure of the value of assets at firms, to the book value of capital invested in the firm, which is the accounting measure of the same value. Figure 5.2 compares the market value of equity to book value at the five firms that you are analyzing:

Figure 5.2: Price to Book Ratio



Note that the price to book value ratio is smallest for Motorola and largest for Rediff.com, a result that is consistent with your categorization of these firms in terms of where they stand in the life cycle.

Historical Growth

When estimating the expected growth for a firm, you 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, you begin by looking at measurement issues that arise when estimating past growth, especially for young technology firms, 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:

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

$$\text{Geometric Average} = \left[\frac{Earnings_0}{Earnings_{-n}}\right]^{(1/n)} - 1 \quad \text{where Earnings}_t = \text{Earnings in year t}$$

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 technology firms, the caveats about using arithmetic growth carry even more weight.

Illustration 5.1: Differences between Arithmetic and Geometric Averages: Motorola

Table 5.1 reports on the revenues, EBITDA and EBIT 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 5.1: Arithmetic and Geometric Average Growth Rates: Motorola

	Revenues	% Change	EBITDA	% Change	EBIT	% Change
1994	$ 22,245		$ 4,151		$ 2,604	
1995	$ 27,037	21.54%	$ 4,850	16.84%	$ 2,931	12.56%
1996	$ 27,973	3.46%	$ 4,268	-12.00%	$ 1,960	-33.13%
1997	$ 29,794	6.51%	$ 4,276	0.19%	$ 1,947	-0.66%
1998	$ 29,398	-1.33%	$ 3,019	-29.40%	$ 822	-57.78%
1999	$ 30,931	5.21%	$ 5,398	78.80%	$ 3,216	291.24%
Arithmetic Average		7.08%		10.89%		42.45%
Geometric Average		6.82%		5.39%		4.31%
Standard deviation		8.61%		41.56%		141.78%

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

The arithmetic average growth rate is lower than the geometric average growth rate for all three items, but the difference is much larger with operating income (EBIT) than it is with revenues and EBITDA. This is because the operating income is the most volatile of the three numbers, with a standard deviation in year-to-year changes of almost 142%. Looking at the operating income in 1994 and 1999, it is also quite clear that the geometric averages are much better indicators of true growth. Motorola's earnings 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.

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:

% change in Earnings in period t = $(\text{Earnings}_t - \text{Earnings}_{t-1})/ \text{Earnings}_{t-1}$

If the earnings in the last period (Earnings_{t-1}) is negative, this calculation yields a meaningless number. This extends into the calculation of the geometric mean. If the earnings in the initial time period is negative or zero, the geometric mean cannot be estimated.

While there are ways of estimating growth even when earnings are negative[1], 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 5.2: Negative Earnings

The problems with estimating earnings growth when earnings are negative are obvious for three of the five firms in the sample that have negative earnings. Amazon's operating earnings (EBIT) went from -$62 million in 1998 to -$276 million in 1999. Clearly, the firm's earnings deteriorated, but estimating a standard earnings growth rate would lead us to the following growth rate:

Earnings growth for Amazon in 1999 = (-276-(-62))/-62 = 3.4516 or 345.16%

You run into similar problems with both Ariba and Rediff.com.

Even with Motorola, which has had positive earnings for much of the last decade, the negative earnings issue comes up when you look at net income and earnings per share over the last 5 years. Table 5.2 below reports on both numbers from 1994 to 1999:

Table 5.2: Net Income and EPS: Motorola

	Net Income	*EPS*
1994	$ 1,560.00	$ 0.88
1995	$ 1,781.00	$ 0.98
1996	$ 1,154.00	$ 0.65
1997	$ 1,180.00	$ 0.66
1998	$ (962.00)	$ (0.54)
1999	$ 817.00	$ 0.45

[1] See Investment Valuation, John Wiley & Sons.

The negative net income (and earnings per share) numbers in 1998 make the estimation of a growth rate in 1999 problematic. For instance, the earnings per share increased from -$0.54 to $0.45 but the growth rate, estimated using the conventional equation, would be:

Earnings growth rate in 1999 = ($0.45-(-$0.54))/(-$0.54) = -183.33%

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 $1999_{\text{absolute value}}$ = ($0.45-(-$0.54))/($0.54) = 83.33%

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

Earnings growth rate in $1999_{\text{Higher value}}$= ($0.45-(-$0.54))/($0.45) = 120.00%

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.

The Usefulness of Historical Growth

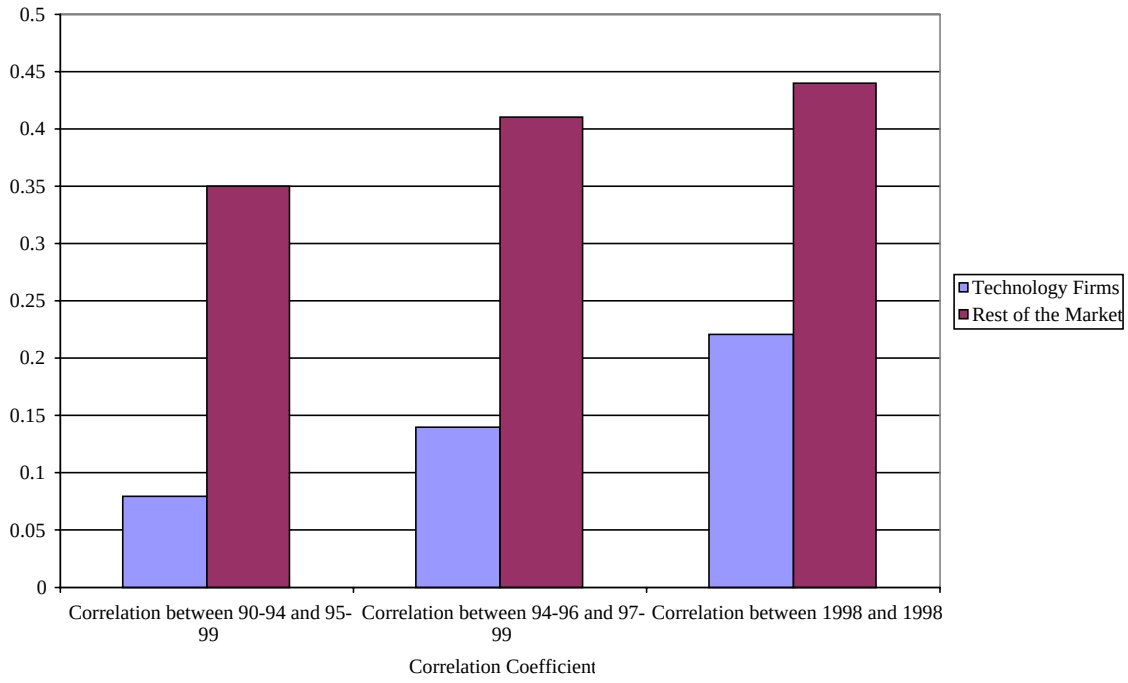
Is the growth rate in the past a good indicator of growth in the future? Not necessarily, especially for technology firms. In this section you consider how good historical growth is as a predictor of future growth for all firms, and why the changing size and volatile businesses of technology firms can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

Higgledy Piggledy Growth

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

The growth rates at technology 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 technology firms relative to the rest of the market is reported in figure 5.3:

Figure 5.3: Correlations in Historical Growth



Source: Compustat

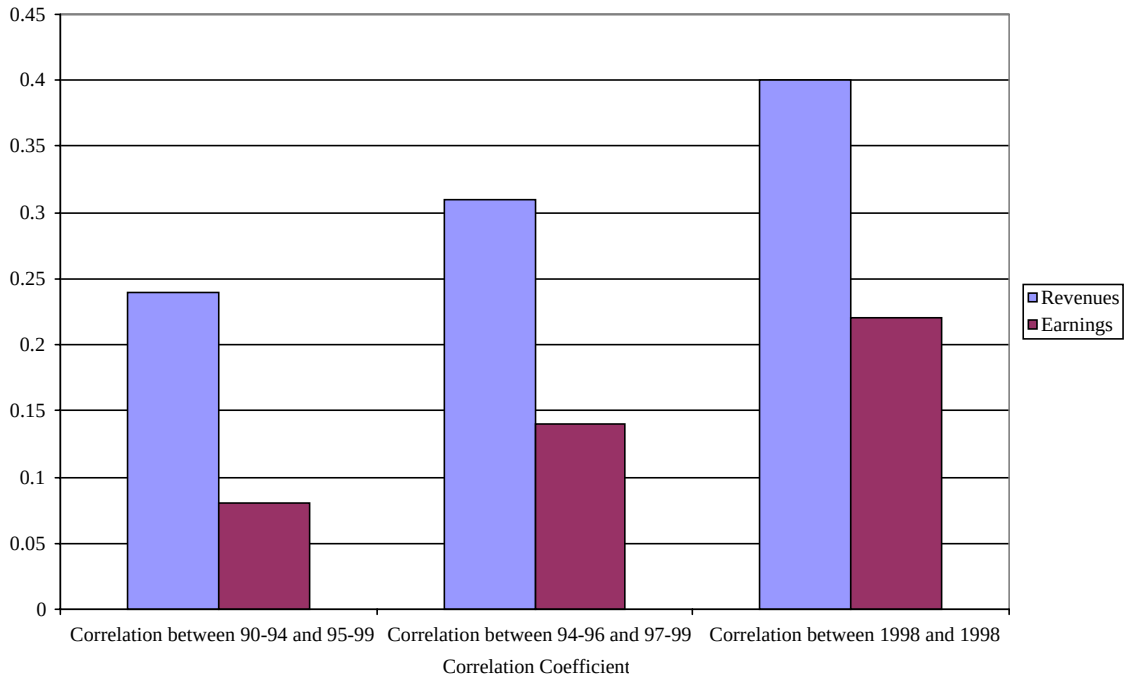
While the correlations tend to be higher across the board for one-year growth rates than for 3-year or 5-year growth rates in earnings, they are also consistently lower for technology firms than they are for the rest of the market. This would suggest that you should be more cautious about using past growth, especially in earnings, for forecasting future growth.

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. While this is true for all firms, it is particularly true for

technology firms which have discretion on when and how much to spend on research and can shift earnings from one period to another much more easily than they can shift revenues. Figure 5.4 compares the correlations in revenue and earnings growth over one year, three year and five year periods at technology firms:

Figure 5.4: Correlations in Revenue and Earnings Growth: Technology Firms



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. 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 technology 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 technology firm lies in how well it handles growth. Some firms, such as Cisco, Oracle and even Amazon, 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, especially new technology firms, have had much more difficulty replicating their success as they become larger. In analyzing small technology 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 5.3: Cisco: Earnings Growth and Size of the Firm

In Table 5.2 below, Cisco's evolution from a firm with $28 million in revenues and net income of about $ 4 million in 1989 to revenues in excess of $12 billion and net income of $2.096 billion in 1999 is reported:

Table 5.2: 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 Technology Firms

The presence of negative earnings, volatile growth rates over time and the rapid changes that technology 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 help when 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 on over time.

Illustration 5.4: Historical Growth Information

Having examined the issues related to how growth rates are estimated, the difficulties created by negative earnings and the effects of changing firm size on growth rates, you can now summarize the estimates of historical growth at the five firms that you will be valuing in Table 5.3:

Table 5.3: Historical Growth Estimates

Growth rates over last 2 and 5 years: Annualized Geometric Averages

	Amazon	*Ariba*	*Cisco*	*Motorola*	*Rediff*
Revenue Growth Rates					
Last year	168.85%	442.70%	43.19%	5.21%	124.71%
Last 2 years	232.88%	672.64%	37.38%	1.89%	NA
Last 5 years	NA	NA	57.78%	6.82%	NA
Operating Income Growth Rates					
Last year	NA	NA	27.77%	291.24%	NA
Last 2 years	NA	NA	27.21%	28.52%	NA
Last 5 years	NA	NA	47.91%	4.31%	NA
Net Income Growth Rates					
Last year	NA	NA	54.69%	NA	NA
Last 2 years	NA	NA	41.35%	-16.79%	NA
Last 5 years	NA	NA	46.09%	-12.13%	NA

The most striking feature of the table is the number of estimates that cannot be obtained, either because the firm is too young or because earnings are negative. You consider

historical revenue growth when making forecasts for each of these firms, but you do not use historical growth in earnings for any of them.

 *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

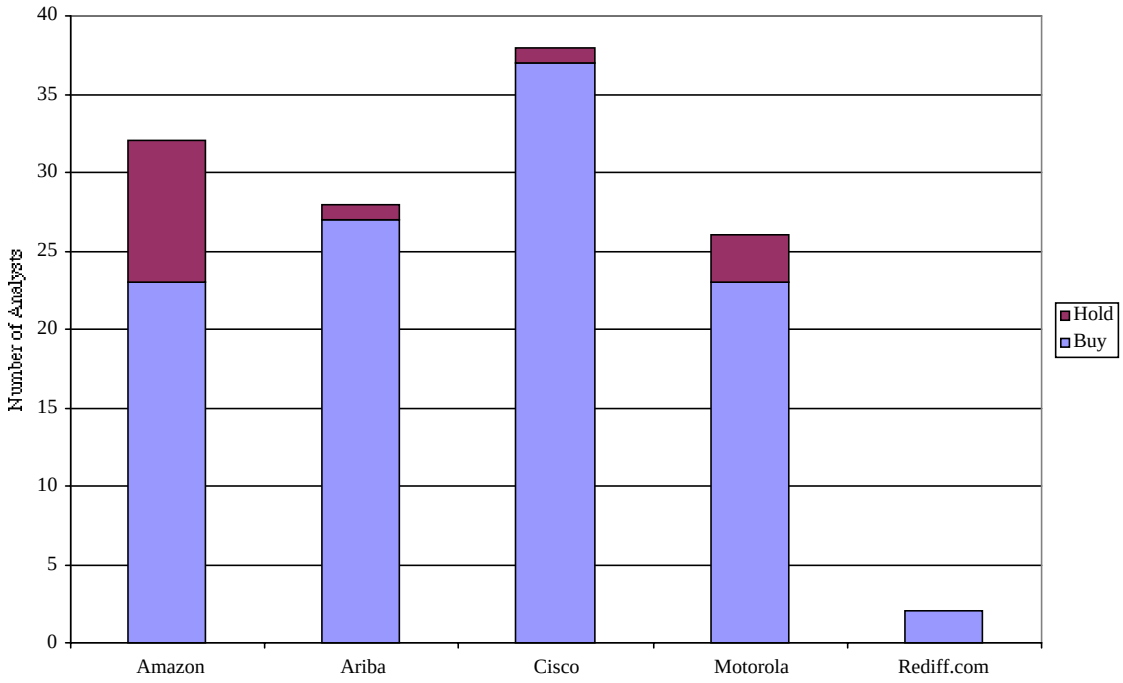
Many technology firms are heavily followed by equity research analysts, who make projections of earnings growth for these firms, sometimes for periods of up to 5 years. How useful are these estimates of expected growth from analysts and how, if at all, can they be used in valuing technology firms? In this section, you consider the process that analysts follow to estimated expected growth and follow up by examining why such growth rates may not be appropriate when valuing technology firms.

How heavily followed are technology firms?

The number of equity research analysts following technology firms is disproportionately large when compared to the number following firms in other sectors for several reasons. The first is that the need for equity research may be greatest in these firms since the values of these firms can shift dramatically with new information on both current investments and future prospects. The second is that institutional investors have increased their holdings of technology firms and analysts tend to follow suit.

The number of analysts, at least on the sell side, following the five firms that you are analyzing is reported in Figure 5.5 below, categorized by whether they have buy, hold or sell recommendations on each of the firms:

Figure 5.5: Analyst Following



Source: Morningstar

While Rediff has only two analysts following it, the other firms have more 20 analysts each following them. The analysts are generally much more positive (buy recommendations) than negative (hold recommendations). It is worth noting that not one of the 126 analysts following these 5 firms has a sell recommendation out. Note also that this understates the number of analysts following these firms since it not only ignores buy-side analysts but also analysts in markets outside the United States.

The Quality of Earnings Forecasts[2]

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

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[2] 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.

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 model for three-quarter ahead forecasts and 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.

Illustration 5.5: Analyst Estimates of Growth

All five of the firms that you are valuing are followed by analysts and table 5.4 provides consensus estimates (median) of earnings and earnings growth both in the short and long term on each of these firms.

Table 5.4: Analyst Estimates of Earnings

	Amazon	*Ariba*	*Cisco*	*Motorola*	*Rediff.xls*
EPS: 2000	$ (1.39)	$ (0.23)	$ 0.53	$ 1.05	$ (0.43)
EPS: 2001	$ (0.80)	$ (0.11)	$ 0.70	$ 1.41	$ 0.10
EPS: Expected 5 year growth rate	NA	NA	32.19%	22.93%	NA

There is considerable disagreement on the expected earnings growth rate even at Cisco and Motorola, and a wide range of estimates on earnings per share in the next two years at the other firms. For the three firms with negative earnings, the estimated growth rate over the next five years cannot be estimated.

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.

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.

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

where,

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

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

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 capital 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 5.6: Measuring the Reinvestment Rate, Return on Capital and Expected Growth Rate – Cisco and Motorola

You will use the most recent year's financial statements to estimate Cisco's and Motorola's reinvestment rates and returns on capital for the year. In chapter 4, you estimated the reinvestments made by the firms and included both R&D expenses and acquisitions in the estimate. Table 5.5 summarizes the estimate of reinvestment both in dollar terms and as a percent of the after-tax operating income at each of the firms.

Table 5.5: Estimating the Reinvestment Rates: Most Recent Financial Year

	Cisco	*Motorola*
Net Capital Expenditures	$ 3,723.40	$ 1,521.60
Change in Non-cash Working Capital	$ (700.00)	$ (829.00)
Reinvestment	$ 3,023.40	$ 692.60
Adjusted EBIT	$ 4,615.70	$ 4,235.60
Adjusted EBIT (1-t)	$ 3,388.49	$ 3,110.00
Reinvestment Rate	89.23%	22.27%

Cisco reinvested almost 90% of its after-tax operating income while Motorola reinvested about a quarter of its after-tax operating income.

The reinvestment rate is a volatile number and often shifts significantly from year to year. In table 5.6, you compare the reinvestment rate in the most recent year to the average reinvestment rate over the last 3 years and the industry average reinvestment rate. You also compute the reinvestment rate for the most recent year with the change in working capital normalized.[3]

Table 5.6: Reinvestment Rate: Historical Averages and Industry Averages

	Cisco	*Motorola*
Reinvestment Rate	89.23%	22.27%

[3] To normalize working capital, you compute the working capital as a percent of revenues at the firm at the end of the most recent year and multiply it by the revenue change in the most recent year to estimate the change in non-cash working capital.

Reinvestment Rate (with normalized working capital)	106.81%	52.99%
Average Reinvestment Rate (last 3 years)	113.16%	71.33%
Industry Average Reinvestment Rate	79.29%	42.93%

Both Cisco and Motorola have lower reinvestment rates in the current year than they have had in the last three years and higher reinvestment rates than comparable firms.

You also estimate the return on capital at Cisco and Motorola in the most recent financial year and compare it to the industry averages and the average over the last three years:

Table 5.7: Returns on Capital: Cisco and Motorola

	Cisco	*Motorola*
UNADJUSTED		
EBIT(1-t)	$ 2,245.75	2090.4
Book Value of Debt	$0.00	5542
Book Value of Equity	7191	12222
Capital Invested	$7,191.00	$17,764.00
Return on Capital	31.23%	11.77%
ADJUSTED FOR OPERATING LEASES & R&D		
EBIT(1-t)	$ 3,388.49	$ 3,110.00
Book Value of Debt	$827.43	$5,542.00
Book Value of Equity	$9,117.00	$20,000.60
Capital Invested	$9,944.43	$25,542.60
Return on Capital	34.07%	12.18%
Average: Last 3 years	38.15%	8.12%
Industry Average	18.34%	22.27%

Cisco earned a return on capital that was significantly higher than the returns earned by comparable firms, reflecting both its technological edge and its superior management. Motorola on the other hand earned a return on capital that was lower than the industry average, though it was higher than what it has earned over the last three years.

Table 5.8 reports estimates for the reinvestment rate and return on capital at Cisco and Motorola, and the expected growth rate that emerges from these estimates.

Table 5.8: Expected Growth Rate Estimates

	Cisco	*Motorola*
A. Last Year's Estimates		
Reinvestment Rate	89.23%	22.27%
ROC	34.07%	12.18%
Expected Growth rate	30.40%	2.71%
B. Last Year's Estimates: With Normalized WC		
Reinvestment Rate	106.81%	52.99%
ROC	34.07%	12.18%
Expected Growth rate	36.39%	6.45%
C. Average over last 3 years		
Reinvestment Rate	113.16%	71.33%
ROC	38.15%	8.12%
Expected Growth rate	43.17%	5.79%
D. Industry Averages		
Reinvestment Rate	79.29%	42.93%
ROC	18.34%	22.27%
Expected Growth rate	14.54%	9.56%

Clearly, the estimates of expected growth are a function of what you assume about future investments. For the valuation, you assume that the current return on capital and reinvestment rate (with normalized working capital) will be sustained for the foreseeable future for Cisco, since the firm is in a growing market and has a surplus of investment opportunities. Cisco's reinvestment rate of 106.81% and return on capital of 34.07% yields an expected growth rate of 36.39% in operating income for the firm. Note that almost two-thirds of this growth comes from Cisco's acquisitions, reflecting both the volume of these acquisitions (in the reinvestment rate) and Cisco's success with this strategy (in the return on capital).

For Motorola, it is assumed that the reinvestment rate will remain at the most recent year's levels (with normalized working capital) but return on capital will be moved towards the industry average (half way between Motorola's return on capital and the industry average). The changing return on capital over time will affect earnings growth and you consider how best to estimate this growth in the next section.

 *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 last 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.

$$\text{Expected Growth Rate} = ROC_t * \text{Reinvestment rate} + (ROC_t - ROC_{t-1})/ROC_t$$

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

$$\text{Expected Growth Rate} = .11 * .40 + (.11 - .10)/.10 = 14.40\%$$

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 on existing investments.

Illustration 5.7: Estimating Expected Growth with Changing Return on Capital

In the previous illustration, you estimated a reinvestment rate of 52.99% for Motorola and a current return on capital of 12.18%. You also established 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[4]. 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 as follows[5]:

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[4] 17.22% is exactly halfway between the current return on capital and the industry average (22.27%).

[5] 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

Expected Growth Rate

$= ROC_{current} * Reinvestment\ Rate_{current} + \{[1+(ROC_{In\ 5\ years} - ROC_{Current})/ROC_{Current}]^{1/5} - 1\}$

$= .1218 * .5299 + \{[1+(.1722-.1218)/.1218]^{1/5} - 1\}$

$= .1363$ or 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.

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 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 5.8: Estimating Revenues at Amazon, Ariba and Rediff.com

You begin by estimating the expected growth in revenues at Amazon, Ariba and Rediff.com. In Table 5.9, the expected revenue growth rates are reported at each of these firms:

Table 5.9: Revenue Growth Rates: Amazon, Ariba and Rediff.com

Year	*Amazon*	*Ariba*	*Rediff.com*
1	120.00%	400.00%	500.00%

2	90.00%	200.00%	300.00%
3	75.00%	150.00%	200.00%
4	50.00%	100.00%	125.00%
5	30.00%	75.00%	100.00%
6	25.20%	60.00%	75.00%
7	20.40%	40.00%	50.00%
8	15.60%	20.00%	25.00%
9	10.80%	10.00%	15.00%
10	5.00%	5.00%	5.00%
Compounded Growth Rate	40.00%	82.39%	104.57%

You based your estimates of growth in the initial years on the growth in revenues over the last year and used higher growth rates for Ariba and Rediff, since they have lower revenues than Amazon. As a check, you also examined, in table 5.10, how much the revenues at each of these firms would be in ten years and how the revenues would compare with those of the largest firms in the businesses in which they operate today:

Table 5.10: Revenue Comparisons

	Amazon	*Ariba*	*Rediff.com*
Current Revenues	$ 1,640	$ 93	$ 2
Revenues in ten years	$ 47,425	$ 37,717	$ 2,569
Comparable firms			
Largest firm	The Gap ($12,090) Walmart ($173,281)	EDS ($18,730)	Yahoo! ($589)

If your projections of revenue growth are borne out, Amazon will have a significant but not overwhelming share of the retail market by the tenth year. Implicitly, you are assuming a number of favorable trends in Amazon's favor – a substantial growth in the overall online retailing market, a strengthening of Amazon's brand name allowing

it to keep ahead of competition and successful partnerships with other online ventures to boost revenues.

With your projections of growth, Ariba, on the other hand, will be significantly larger than the largest firms in its peer group. However, its target market is a huge one and if Ariba succeeds in opening up the market, the growth rate is attainable. Here again, you are assuming that Ariba has a good chance of winning the technology battle with competitors like Commerce One and that conventional firms will in fact expand their use of online ventures for business services.

Finally, Yahoo, the internet portal with the largest revenues, is still a very young firm with revenues of only $589 million. Rediff.com, with projected growth, will be almost five times larger in ten years. Again, you are assuming that there will continue to be exponential growth in the overall Indian market that will make this feasible. You are also assuming that Rediff will be able to tap into other revenue sources and perhaps even other businesses to generate this growth.

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. 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 5.9: Estimating Operating Margins

To estimate the operating margins for Amazon, Ariba and Rediff.com, you begin by estimating the operating margins of the businesses that each firm is in. In Table 5.11, you define these businesses and estimate the target operating margins:

Table 5.11: Target Operating Margins

	Amazon	*Ariba*	*Rediff.com*
Business	Specialty Retailing	Business Services/ Software	Internet Portals
Pre-tax Operating Margin	9.32%	16.36%	40.00%

The pre-tax operating margin[6] for internet portals is estimated prior to selling, general and administrative expenses to be consistent with your treatment of these expenses as capital expenses for Rediff.com.

The firms are all losing money currently and have negative operating margins. You assume that the firms will move toward their target margins, with greater marginal improvements[7] in the earlier years and smaller ones in the later years. Table 5.12 summarizes the expected operating margins over time for all three firms:

Table 5.12: Expected Operating Margins

Year	*Amazon*	*Ariba*	*Rediff.com*
Current	-16.27%	-159.84%	-113.10%
1	-3.48%	-71.74%	-36.55%
2	2.92%	-27.69%	1.73%
3	6.12%	-5.67%	20.86%
4	7.72%	5.35%	30.43%
5	8.52%	10.85%	35.22%
6	8.92%	13.61%	37.61%
7	9.12%	14.98%	38.80%

[6] I used the operating margin prior to selling expenses at Yahoo! to get the estimate.

[7] The margin each year is computed as follows:

8	9.22%	15.67%	39.40%
9	9.27%	16.02%	39.70%
10	9.30%	16.19%	39.85%
Terminal year	9.32%	16.36%	40.00%

Since you estimated revenue growth in the last section and the margins in this one, you can now estimate the pre-tax operating income at each of the firms over the next 10 years in Table 5.13:

Table 5.13: Expected Operating Income

Year	Amazon	Ariba	Rediff.com
1	$ (587)	$ (740)	$ (13)
2	$ (238)	$ (996)	$ (17)
3	$ 351	$ (961)	$ 2
4	$ 1,101	$ (393)	$ 64
5	$ 1,806	$ 650	$ 188
6	$ 2,495	$ 2,110	$ 381
7	$ 3,146	$ 3,703	$ 610
8	$ 3,718	$ 4,893	$ 786
9	$ 4,164	$ 5,629	$ 918
10	$ 4,396	$ 6,041	$ 971

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

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.

(Margin this year + Target margin)/2

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 then, 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 retailers, in the case of Amazon. 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 5.10: Estimated Sales to Capital Ratios

To estimate how much Amazon, Ariba and Rediff.com have to invest to generate the expected revenue growth, you estimate the firm's current sales to capital ratio, its marginal sales to capital ratio in the last year and the average sales to capital ratio for the businesses that each operates in:

Table 5.14: Sales to Capital Ratio Estimates

	Amazon	Ariba	Rediff.com

Firm's Sales to Capital	0.94	0.75	NA
Marginal Sales to Capital: Most recent year	2.86	2.88	NA
Industry average Sales to Capital	3.18	2.33	0.70
Sales to Capital Ratio used in valuation	3.02	2.50	1.00

You used a sales to capital ratio of 3.02 for Amazon and 2.50 for Ariba, approximately midway through their marginal sales to capital ratio from last year and the industry average. For Rediff, the industry average reflects the average sales to capital ratio for internet portals and you set the sales to capital ratio at a slightly higher number.

Based upon these estimates of the sales to capital ratio for each firm, you can now estimate how much each firm will have to reinvest each year for the next 10 years in table 5.15:

Table 5.15: Estimated Reinvestment Needs

	Amazon		Ariba		Rediff.com	
Year	Increase in Revenue	Reinvestment	Increase in Revenue	Reinvestment	Increase in Revenue	Reinvestment
1	$ 1,968	$ 652	$ 370	$ 148	$ 9.53	$ 9.53
2	$ 3,247	$ 1,075	$ 926	$ 370	$ 34.31	$ 34.31
3	$ 5,141	$ 1,702	$ 2,083	$ 833	$ 91.49	$ 91.49
4	$ 5,998	$ 1,986	$ 3,471	$ 1,388	$ 171.54	$ 171.54
5	$ 5,398	$ 1,788	$ 5,207	$ 2,083	$ 308.77	$ 308.77
6	$ 5,895	$ 1,952	$ 7,289	$ 2,916	$ 463.16	$ 463.16
7	$ 5,975	$ 1,978	$ 7,775	$ 3,110	$ 540.35	$ 540.35
8	$ 5,501	$ 1,822	$ 5,443	$ 2,177	$ 405.26	$ 405.26
9	$ 4,403	$ 1,458	$ 3,266	$ 1,306	$ 303.95	$ 303.95
10	$ 2,258	$ 748	$ 1,796	$ 718	$ 116.51	$ 116.51

As a final check, you estimate the return on capital each year for the next 10 years for all three firms in Table 5.16.

Table 5.16: Estimated Return on Capital

Year	*Amazon*	*Ariba*	*Rediff.com*
1	-7.18%	-218.10%	-73.69%

2	8.35%	-128.01%	5.19%
3	17.25%	-29.33%	38.21%
4	17.45%	24.69%	40.98%
5	18.09%	36.49%	42.79%
6	18.97%	34.56%	40.23%
7	19.17%	33.59%	35.67%
8	18.97%	30.24%	30.22%
9	18.51%	28.38%	28.03%
10	17.73%	27.40%	25.69%
Industry average	16.94%	23.96%	35.25%

The returns-on-capital at all three firms converge to sustainable levels, at least relative to industry averages, by the terminal year. This suggests that your 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 John Chambers is CEO is one reason why Cisco's return on capital is allowed to remain at 34% and why it is assumed that Cisco will continue to be successful in its path of growing through acquisitions.
- 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 Amazon's capacity to market its products effectively to assume a high turnover ratio (a sales to capital ratio of 3) and a high target margin (9.32%). 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. Cisco's reinvestment and growth come from acquisitions, Amazon's from investments in distribution and partnerships with other firms, Motorola's and Ariba's from investments in technology and research and Rediff's from investment in marketing. The effectiveness of these reinvestment strategies is captured in the return on capital that you assume for the future, with Cisco assumed to be the most effective (with the highest return on capital) and Motorola the least effective (with the lowest return on capital).
- The strength of the competition that firms face is in the background but it does determine how high excess returns (return on captial – cost of capital) will be, and how quickly they will slide. Thus, you are assuming that Cisco will continue to

dominate its competitors over the next decade when you assume that the firm's excess returns will remain at current levels for that period.

Thus, every qualitative factor is quantified and the 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 Amazon will grow at 60% a year because the online retailing market is so huge and that Cisco will grow 50% a year because it has great management. While there is 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 and reinvestment rates, and consequently, on 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 technology 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.

You considered three approaches to estimating fundamental growth. In the first, you considered a firm with a sustainable reinvestment rate and return and capital and argued that growth is the product of the two for this firm. In the second, you considered a firm with a changing return on capital and noted that there will be an additional component of growth for this firm. If the return on capital improves, growth will be higher, whereas if it drops, growth will be lower. The third approach, designed for firms with changing margins, begins with forecasted revenues, and then used estimated margins to arrive at operating income each year. Consistency is maintained by requiring that the firm reinvest a sufficient amount to create the revenue growth each year.