CHAPTER 4

RELATIVE VALUATION

In discounted cash flow valuation, the objective is to find the value of an asset, given its cash flow, growth and risk characteristics. In relative valuation, the objective is to value an asset, based upon how similar assets are currently priced by the market. Consequently, there are two components to relative valuation. The first is that to value assets on a relative basis, prices have to be standardized, usually by converting prices into multiples of some common variable. While this common variable will vary across assets, it usually takes the form of earnings, book value or revenues for publicly traded stocks.. The second is to find similar assets, which is difficult to do since no two assets are exactly identical. With real assets like antiques and baseball cards, the differences may be small and easily controlled for when pricing the assets. In the context of valuing equity in firms, the problems are compounded since firms in the same business can still differ on risk, growth potential and cash flows. The question of how to control for these differences, when comparing a multiple across several firms, becomes a key one.

While relative valuation is easy to use and intuitive, it is also easy to misuse. In this chapter, we will develop a four-step process for doing relative valuation. In the process, we will also develop a series of tests that can be used to ensure that multiples are correctly used.

What is relative valuation?

In relative valuation, we value an asset based upon how similar assets are priced in the market. A prospective house buyer decides how much to pay for a house by looking at the prices paid for similar houses in the neighborhood. A baseball card collector makes a judgment on how much to pay for a Mickey Mantle rookie card by checking transactions prices on other Mickey Mantle rookie cards. In the same vein, a potential investor in a stock tries to estimate its value by looking at the market pricing of "similar" stocks.

Embedded in this description are the three essential steps in relative valuation. The first step is finding comparable assets that are priced by the market, a task that is easier to accomplish with real assets like baseball cards and houses than it is with stocks.

All too often, analysts use other companies in the same sector as comparable, comparing a software firm to other software firms or a utility to other utilities, but we will question whether this practice really yields similar companies later in this chapter. The second step is <u>scaling the market prices to a common variable</u> to generate standardized prices that are comparable. While this may not be necessary when comparing identical assets (Mickey Mantle rookie cards), it is necessary when comparing assets that vary in size or units. Other things remaining equal, a smaller house or apartment should trade at a lower price than a larger residence. In the context of stocks, this equalization usually requires converting the market value of equity or the firm into multiples of earnings, book value or revenues. The third and last step in the process is <u>adjusting for differences across assets</u> when comparing their standardized values. Again, using the example of a house, a newer house with more updated amenities should be priced higher than a similar sized older house that needs renovation. With stocks, differences in pricing across stocks can be attributed to all of the fundamentals that we talked about in discounted cash flow valuation. Higher growth companies, for instance, should trade at higher multiples than lower growth companies in the same sector. Many analysts adjust for these differences qualitatively, making every relative valuation a story telling experience; analysts with better and more believable stories are given credit for better valuations.

There is a significant philosophical difference between discounted cash flow and relative valuation. In discounted cash flow valuation, we are attempting to estimate the intrinsic value of an asset based upon its capacity to generate cash flows in the future. In relative valuation, we are making a judgment on how much an asset is worth by looking at what the market is paying for similar assets. If the market is correct, on average, in the way it prices assets, discounted cash flow and relative valuations may converge. If, however, the market is systematically over pricing or under pricing a group of assets or an entire sector, discounted cash flow valuations can deviate from relative valuations.

The Ubiquity of Relative Valuation

Notwithstanding the focus on discounted cash flow valuation in classrooms and in theory, there is evidence that most assets are valued on a relative basis. In fact, consider the following:

- Most equity research reports are based upon multiples: price earnings ratios, enterprise value to EBITDA, price and price to sales ratios are but a few example. In a study of 550 equity research reports in early 2001, relative valuations outnumbered discounted valuations almost ten to one.[1] While many equity research reports included the obligatory cash flow tables, values were estimated and recommendations were made by looking at comparable firms and using multiples. Thus, when analysts contend that a stock is under or over valued, they are usually making that judgment based upon a relative valuation.

- Discounted cash flow techniques are more common in acquisitions and corporate finance. While casual empiricism suggests that almost every acquisition is backed up by a discounted cash flow valuation, the value paid in the acquisition is often determined using a multiple. In acquisition valuation, many discounted cash flow valuations are themselves relative valuations in disguise because the terminal values are computed using multiples.

- Most investment rules of thumb are based upon multiples. For instance, many investors consider companies that trade at less than book value as cheap as well as stocks that trade at PE ratios that are less than the expected growth rates.

Given that relative valuation is so dominant in practice, it would be a mistake to dismiss it as a tool of the unsophisticated. As we will argue in this chapter and the next two, relative valuation has a role to play that is separate and different from discounted cash flow valuation.

Reasons for Popularity and potential pitfalls

Why is the use of relative valuation so widespread? Why do managers and analysts relate so much better to a value based upon a multiple and comparables than to discounted cash flow valuation? In this section, we consider some of the reasons for the popularity of multiples.

a. It is less time and resource intensive than discounted cash flow valuation: Discounted cash flow valuations require substantially more information than relative valuation. For

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[1] The study by the author included sell-side equity research reports from different investment banks in the US, London and Asia. About 75% were from the US, about 15% from Europe and 10% for Asia.

analysts who are faced with time constraints and limited access to information, relative valuation offers a less time intensive alternative.

b. It is easier to sell: In many cases, analysts, in particular, and sales people, in general, use valuations to sell stocks to investors and portfolio managers. It is far easier to sell a relative valuation than a discounted cash flow valuation. After all, discounted cash flow valuations can be difficult to explain to clients, especially when working under a time constraint – many sales pitches are made over the phone to investors who have only a few minutes to spare for the pitch. Relative valuations, on the other hand, fit neatly into short sales pitches. In political terminology, it is far easier to spin a relative valuation than it is to spin a discounted cash flow valuaton.

c. It is easy to defend: Analysts are often called upon to defend their valuation assumptions in front of superiors, colleagues and clients. Discounted cash flow valuations, with their long lists of explicit assumptions are much more difficult to defend than relative valuations, where the value used for a multiple often comes from what the market is paying for similar firms. It can be argued that the brunt of the responsibility in a relative valuation is borne by financial markets. In a sense, we are challenging investors who have a problem with a relative valuation to take it up with the market, if they have a problem with the value.

d. Market Imperatives: Relative valuation is much more likely to reflect the current mood of the market, since it attempts to measure relative and not intrinsic value. Thus, in a market where all internet stocks see their prices bid up, relative valuation is likely to yield higher values for these stocks than discounted cash flow valuations. In fact, by definition, relative valuations will generally yield values that are closer to tmarket prices than discounted cash flow valuations, across all stocks. This is particularly important for those investors whose job it is to make judgments on relative value and who are themselves judged on a relative basis. Consider, for instance, managers of technology mutual funds. These managers will be judged based upon how their funds do relative to other technology funds. Consequently, they will be rewarded if they pick technology stocks that are under valued relative to other technology stocks, even if the entire sector is over valued.

The strengths of relative valuation are also its weaknesses. First, the ease with which a relative valuation can be put together, pulling together a multiple and a group of comparable firms, can also result in inconsistent estimates of value where key variables such as risk, growth or cash flow potential are ignored. Second, the fact that multiples reflect the market mood also implies that using relative valuation to estimate the value of an asset can result in values that are too high, when the market is over valuing comparable firms, or too low, when it is under valuing these firms. Third, while there is scope for bias in any type of valuation, the lack of transparency regarding the underlying assumptions in relative valuations make them particularly vulnerable to manipulation. A biased analyst who is allowed to choose the multiple on which the valuation is based and to choose the comparable firms can essentially ensure that almost any value can be justified.

Standardized Values and Multiples

When comparing identical assets, we can compare the prices of these assets. Thus, the price of a Tiffany lamp or a Mickey Mantle rookie card can be compared to the price at which an identical item was bought or sold in the market. However, comparing assets that are not exactly similar can be a challenge. If we have to compare the prices of two buildings of different sizes in the same location, the smaller building will look cheaper unless we control for the size difference by computing the price per square foot. Things get even messier when comparing publicly traded stocks across companies. After all, the price per share of a stock is a function both of the value of the equity in a company and the number of shares outstanding in the firm. Thus, a stock split that doubles the number of units will approximately halve the stock price. To compare the values of "similar" firms in the market, we need to standardize the values in some way by scaling them to a common variable. In general, values can be standardized relative to the earnings firms generate, to the book value or replacement value of the firms themselves, to the revenues that firms generate or to measures that are specific to firms in a sector.

1. Earnings Multiples

One of the more intuitive ways to think of the value of any asset is as a multiple of the earnings that asset generates. When buying a stock, it is common to look at the

price paid as a multiple of the earnings per share generated by the company. This price/earnings ratio can be estimated using current earnings per share, yielding a current PE, earnings over the last 4 quarters, resulting in a trailing PE, or an expected earnings per share in the next year, providing a forward PE.

When buying a business, as opposed to just the equity in the business, it is common to examine the value of the firm as a multiple of the operating income or the earnings before interest, taxes, depreciation and amortization (EBITDA). While, as a buyer of the equity or the firm, a lower multiple is better than a higher one, these multiples will be affected by the growth potential and risk of the business being acquired.

2. Book Value or Replacement Value Multiples

While financial markets provide one estimate of the value of a business, accountants often provide a very different estimate of value of for the same business. The accounting estimate of book value is determined by accounting rules and is heavily influenced by the original price paid for assets and any accounting adjustments (such as depreciation) made since. Investors often look at the relationship between the price they pay for a stock and the book value of equity (or net worth) as a measure of how over- or undervalued a stock is; the price/book value ratio that emerges can vary widely across industries, depending again upon the growth potential and the quality of the investments in each. When valuing businesses, we estimate this ratio using the value of the firm and the book value of all assets or capital (rather than just the equity). For those who believe that book value is not a good measure of the true value of the assets, an alternative is to use the replacement cost of the assets; the ratio of the value of the firm to replacement cost is called Tobin's Q.

3. Revenue Multiples

Both earnings and book value are accounting measures and are determined by accounting rules and principles. An alternative approach, which is far less affected by accounting choices, is to use the ratio of the value of a business to the revenues it generates. For equity investors, this ratio is the price/sales ratio (PS), where the market value of equity is divided by the revenues generated by the firm. For firm value, this ratio can be modified as the enterprise value/to sales ratio (VS), where the numerator becomes

the market value of the operating assets of the firm. This ratio, again, varies widely across sectors, largely as a function of the profit margins in each. The advantage of using revenue multiples, however, is that it becomes far easier to compare firms in different markets, with different accounting systems at work, than it is to compare earnings or book value multiples.

4. Sector-Specific Multiples

While earnings, book value and revenue multiples are multiples that can be computed for firms in any sector and across the entire market, there are some multiples that are specific to a sector. For instance, when internet firms first appeared on the market in the later 1990s, they had negative earnings and negligible revenues and book value. Analysts looking for a multiple to value these firms divided the market value of each of these firms by the number of hits generated by that firm's web site. Firms with lower market value per customer hit were viewed as under valued. More recently, cable companies have been judged by the market value per cable subscriber, regardless of the longevity and the profitably of having these subscribers.

While there are conditions under which sector-specific multiples can be justified, they are dangerous for two reasons. First, since they cannot be computed for other sectors or for the entire market, sector-specific multiples can result in persistent over or under valuations of sectors relative to the rest of the market. Thus, investors who would never consider paying 80 times revenues for a firm might not have the same qualms about paying $2000 for every page hit (on the web site), largely because they have no sense of what high, low or average is on this measure. Second, it is far more difficult to relate sector specific multiples to fundamentals, which is an essential ingredient to using multiples well. For instance, does a visitor to a company's web site translate into higher revenues and profits? The answer will not only vary from company to company, but will also be difficult to estimate looking forward.

## The Four Basic Steps to Using Multiples

Multiples are easy to use and easy to misuse. There are four basic steps to using multiples wisely and for detecting misuse in the hands of others. The first step is to ensure that the multiple is defined consistently and that it is measured uniformly across

the firms being compared. The second step is to be aware of the cross sectional distribution of the multiple, not only across firms in the sector being analyzed but also across the entire market. The third step is to analyze the multiple and understand not only what fundamentals determine the multiple but also how changes in these fundamentals translate into changes in the multiple. The final step is finding the right firms to use for comparison and controlling for differences that may persist across these firms.

1. Definitional Tests

Even the simplest multiples are defined differently by different analysts. Consider, for instance, the price earnings ratio (PE), the most widely used valuation multiple in valuation. Analysts define it to be the market price divided by the earnings per share but that is where the consensus ends. There are a number of variants on the PE ratio. While the current price is conventionally used in the numerator, there are some analysts who use the average price over the last six months or a year. The earnings per share in the denominator can be the earnings per share from the most recent financial year (yielding the current PE), the last four quarters of earnings (yielding the trailing PE) and expected earnings per share in the next financial year (resulting in a forward PE). In addition, earnings per share can be computed based upon primary shares outstanding or fully diluted shares and can include or exclude extraordinary items. Figure 4.1 provides some of the PE ratios for Google in November 2008 using different estimates of earnings per share.

Figure 4.1: Google - PE Ratios in November 2008
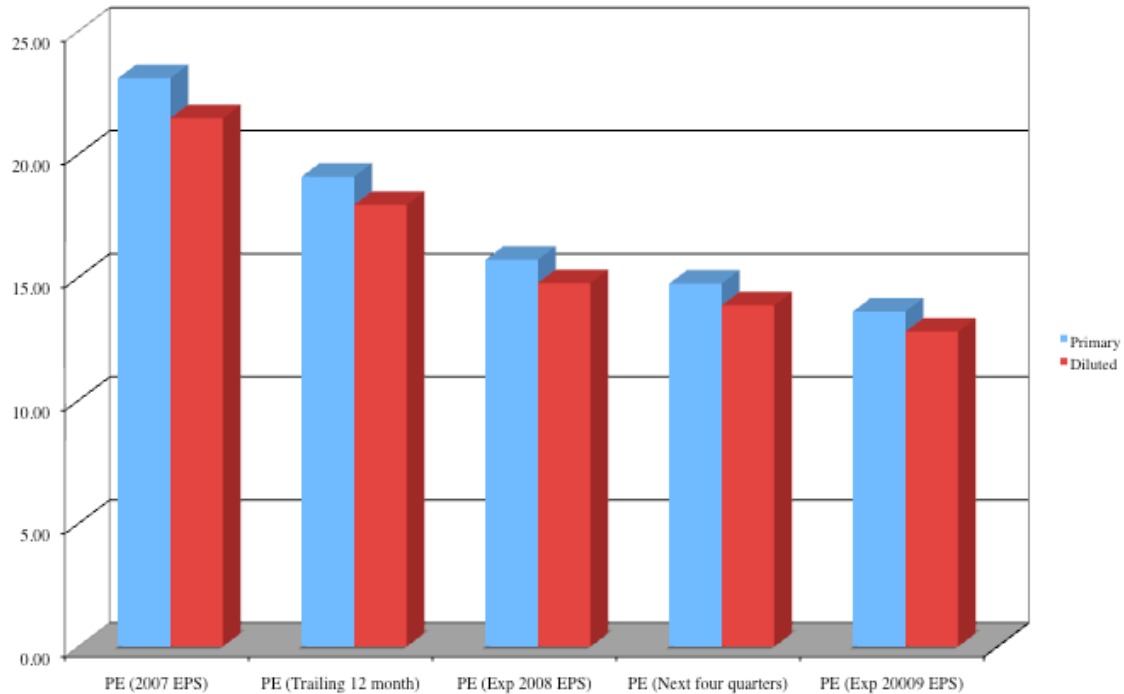
Not only can these variants on earnings yield vastly different values for the price earnings ratio but the one that gets used by analysts depends upon their biases. For instance, in periods of rising earnings, the forward PE will yield consistently lower values than the trailing PE, which, in turn, will be lower than the current PE. A bullish analyst will tend to use the forward PE to make the case that the stock is trading at a low multiple of earnings, while a bearish analyst will focus on the current PE to make the case that the multiple is too high. The first step when discussing a valuation based upon a multiple is to ensure that everyone in the discussion is using the same definition for that multiple.

Consistency

Every multiple has a numerator and a denominator. The numerator can be either an equity value (such as market price or value of equity) or a firm value (such as enterprise value, which is the sum of the values of debt and equity, net of cash). The denominator can be an equity measure (such as earnings per share, net income or book value of equity) or a firm measure (such as operating income, EBITDA or book value of capital).

One of the key tests to run on a multiple is to examine whether the numerator and denominator are defined consistently. *If the numerator for a multiple is an equity value, then the denominator should be an equity value as well. If the numerator is a firm value, then the denominator should be a firm value as well.* To illustrate, the price earnings ratio is a consistently defined multiple, since the numerator is the price per share (which is an equity value) and the denominator is earnings per share (which is also an equity value). So is the Enterprise value to EBITDA multiple, since the numerator and denominator are both firm value measures; the enterprise value measures the market value of the operating assets of a company and the EBITDA is the cashflow generated by the operating assets, prior to taxes and reinvestment needs.

Are there any multiples in use that are inconsistently defined? Consider the price to EBITDA multiple, a multiple that has acquired adherents in the last few years among analysts. The numerator in this multiple is an equity value and the denominator is a measure of earnings to the firm. The analysts who use this multiple will probably argue that the inconsistency does not matter since the multiple is computed the same way for all of the comparable firms; but they would be wrong. If some firms on the list have no debt and others carry significant amounts of debt, the latter will look cheap on a price to EBITDA basis, when in fact they might be over or correctly priced.

Uniformity

In relative valuation, the multiple is computed for all of the firms in a group and then compared across these firms to make judgments on which firms are over priced and which are under priced. For this comparison to have any merit, the multiple has to be defined uniformly across all of the firms in the group. Thus, if the trailing PE is used for one firm, it has to be used for all of the others as well. In fact, one of the problems with using the current PE to compare firms in a group is that different firms can have different fiscal-year ends. This can lead to some firms having their prices divided by earnings from July 2007 to June 2008, with other firms having their prices divided by earnings from January 2008 to December 2008. While the differences can be minor in mature sectors, where earnings do not make quantum jumps over six months, they can be large in high-growth sectors.

With both earnings and book value measures, there is another component to be concerned about and that is the accounting standards used to estimate earnings and book values. Differences in accounting standards can result in very different earnings and book value numbers for similar firms. This makes comparisons of multiples across firms in different markets, with different accounting standards, very difficult. Even with the same accounting standards governing companies, there can be differences in firms that arise because of discretionary accounting choices. There is also the additional problem posed by the fact that some firms use different accounting rules (on depreciation and expensing) for reporting purposes and tax purposes and others do not.[2] In summary, companies that use aggressive assumptions in measuring earnings will look cheaper on earnings multiples than firms that adopt conservative accounting practices.

2. Descriptive Tests

When using a multiple, it is always useful to have a sense of what a high value, a low value or a typical value for that multiple is in the market. In other words, knowing the distributional characteristics of a multiple is a key part of using that multiple to identify under or over valued firms. In addition, we need to understand the effects of outliers on averages and unearth any biases in these estimates, introduced in the process of estimating multiples. In the final part of this section, we will look at how the distributions of multiples shift over time.

Distributional Characteristics

Many analysts who use multiples have a sector focus and have a good sense of how different firms in their sector rank on specific multiples. What is often lacking, however, is a sense of how the multiple is distributed across the entire market. Why should a software analyst care about price earnings ratios of utility stocks? Because both software and utility stocks are competing for the same investment dollar, they have to, in a sense, play by the same rules. Furthermore, an awareness of how multiples vary across

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[2] Firms that adopt different rules for reporting and tax purposes generally report higher earnings to their stockholders than they do to the tax authorities. When they are compared on a price earnings basis to firms that do not maintain different reporting and tax books, they will look cheaper (lower PE).

sectors can be very useful in detecting when the sector we are analyzing is over or under valued.

What are the distributional characteristics that matter? The standard statistics – the <u>average</u> and <u>standard deviation</u> – are where we should start, but they represent the beginning of the exploration. In markets like the United States, characterized by diverse companies in very different businesses there will be significant variation across companies on any multiple at any point in time. Table 4.1 summarizes the average and standard deviation for three widely used multiples -price earnings ratios, price to book value ratios and enterprise value to EBITDA multiple – in January 2008 in the United States. In addition, the maximum and minimum values on

Table 4.1:Summary Statistics on Multiples

	Current PE	Price to Book Equity	EV/EBITDA
Average	45.02	5.15	37.40
Median	18.16	2.07	7.36
Standard Deviation	299.11	23.17	331.98
Standard Error	4.64	0.31	4.76
Minimum	0.50	0.00	0.69
Maximum	15126.20	998.63	11120.00

Note that the lowest value that any company can register on any of these multiples is zero whereas the highest values are unbounded. As a result, the distributions for these multiples are skewed towards the positive values. Figure 4.2 compares the distribution of values for a typical multiple to a normal distribution:

Figure 4.2: Distribution of a Multiple versus Normal Distribution

Value of Multiple
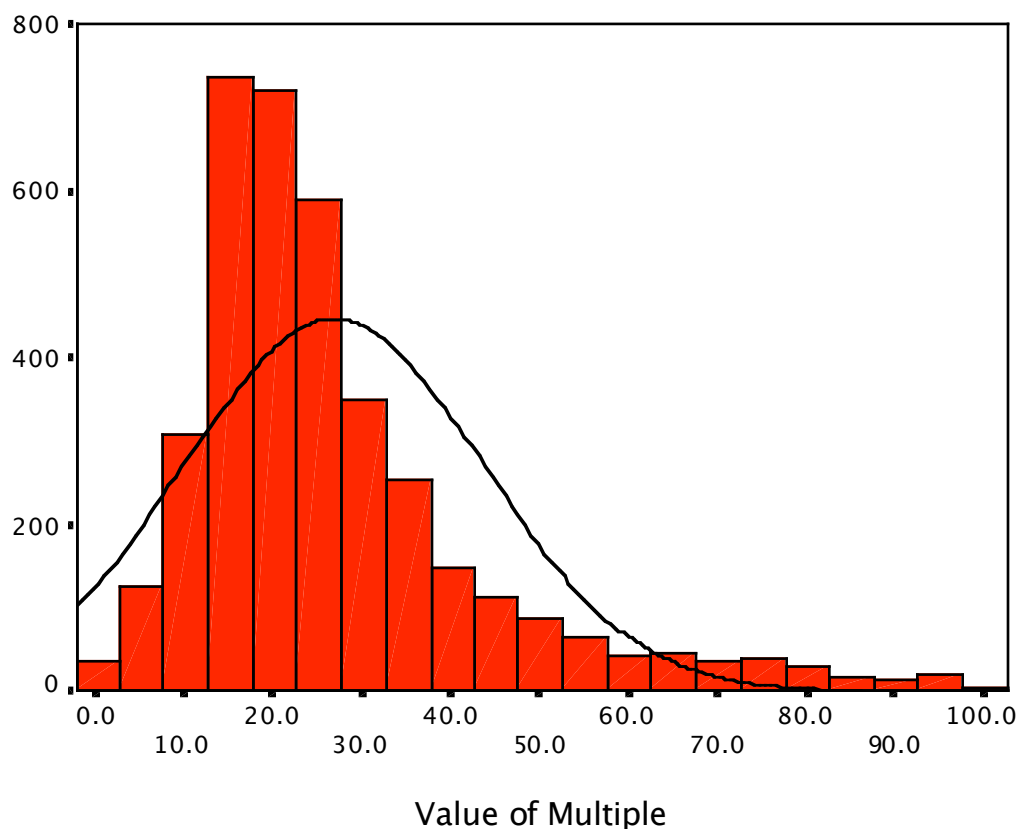
The consequences of asymmetric distributions for investors and analysts are significant:

a. <u>Average versus Median values</u>: As a result of the positively skewed distributions, the average values for multiples will be higher than <u>median</u> values[3]. For instance, the median PE ratio in January 2008 was 18, well below the average PE reported in table 4.1 and this is true for all multiples. The median value is much more representative of the typical firm in the group and any comparisons should be made to medians. The standard sales pitch of a stock being cheap because it trades at a multiple less than the average for the sector should be retired in favor of one which compares the stock's pricing to the median for the sector.

b. <u>Probabilistic statements</u>: As a result of the focus on normal distributions in most statistics classes, we begin attributing its properties to all distributions. For instance, it is true that the probability of values in a normal distribution falling more than two

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[3] With the median, half of all firms in the group fall below this value and half lie above.

standard deviations away from the mean is very small. In the case of the PE ratio, this rule would suggest that few companies should have PE ratios that fall below 35.74 (which is the average of 45.02 minus two standard errors) or above 54.30 (the average plus two standard errors). The reality is that there are thousands of firms that fall outside this range. While the maximum and minimum values are usually of limited use, the percentile values (10th percentile, 25th percentile, 75th percentile, 90th percentile, etc.) can be useful in judging what a high or low value for the multiple in the group is.

Outliers and Averages

As noted earlier, multiples are unconstrained on the upper end and firms can trade at multiples of 500 or 2000 or even 10000. This can occur not only because of high stock prices but also because earnings at firms can sometime drop to a few cents or even a fraction of a cent. These outliers will result in averages that are not representative of the sample. In many cases, data reporting services (such as Value Line and Standard and Poors) that compute and report average values for multiples either throw out these outliers when computing the averages or constrain the multiples to be less than or equal to a fixed number. For instance, any firm that has a price earnings ratio greater than 500 will be assumed to have a price earnings ratio of 500. The consequence is that the averages reported by two services for the same sector or market will almost never match up because they deal with outliers differently. In November 2008, for instance, the average PE reported for the S&P 500 varied widely across services from a low value of 11.5 on Yahoo! Finance to 14.2 on Morningstar. It is incumbent on those investors using these numbers to be clear about how they are computed and consistent in their comparisons.

Biases in Estimating Multiples

With every multiple, there are firms for which the multiple cannot be computed. Consider again the price-earnings ratio. When the earnings per share are negative, the price earnings ratio for a firm is not meaningful and is usually not reported. When looking at the average price earnings ratio across a group of firms, the firms with negative earnings will all drop out of the sample because the price earnings ratio cannot

be computed. Why should this matter when the sample is large? The fact that the firms that are taken out of the sample are the firms losing money creates a bias in the selection process. In fact, the average PE ratio for the group will be biased upwards because of the elimination of these firms.

There are three solutions to this problem. The first is to be aware of the bias and build it into the analysis. In practical terms, this will mean adjusting the average PE down to reflect the elimination of the money-losing firms. The second is to aggregate the market value of equity and net income (or loss) for all of the firms in the group, including the money-losing ones, and compute the price earnings ratio using the aggregated values. Figure 4.3 summarizes the average PE ratio, the median PE ratio and the PE ratio based upon aggregated earnings for three sectors – semiconductors, telecom services and trucking – in January 2008.

Figure 4.3: Sector PE – Average, Median and Aggregate Values
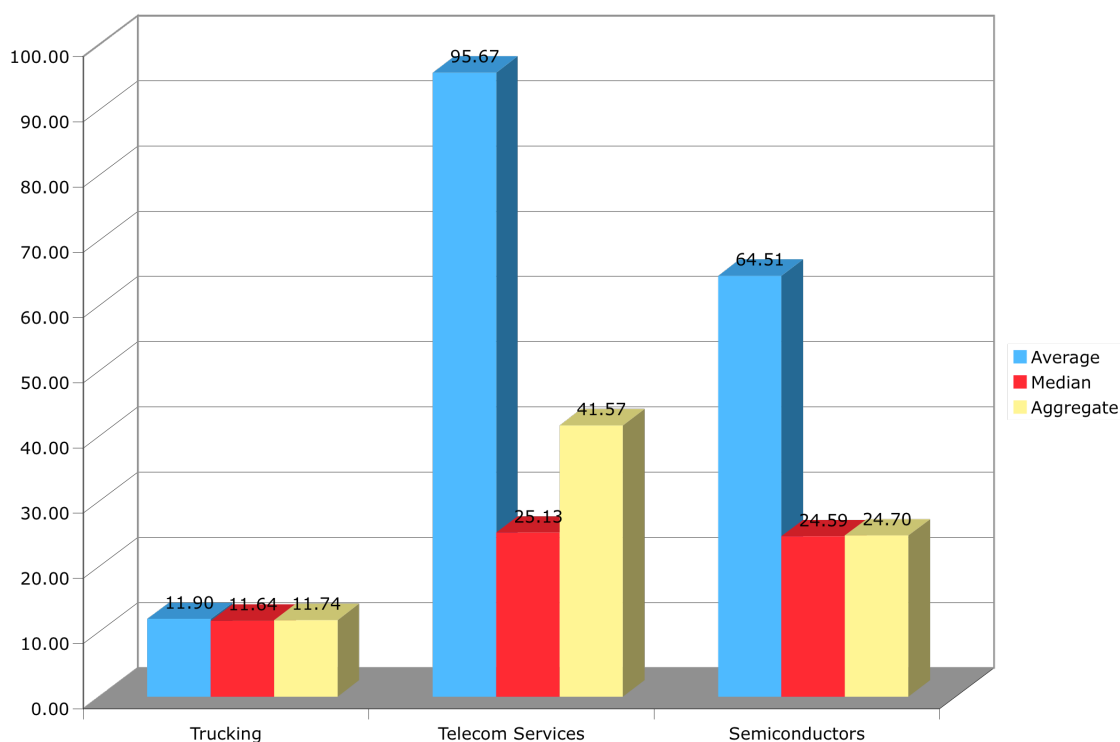
Note that the median PE ratio is significantly lower than the average PE in the telecom services and semiconductor business, indicating the presence of large outliers (PE) for some firms in both businesses. In both these businesses, the PE ratio based upon the aggregate market cap and net income is closer to the median than the average. In the

trucking sector, all three values are close, indicating that there are few outliers in this business and that the PE ratios for firms tend to be bunched together. The third choice is to use a multiple that can be computed for all of the firms in the group. The inverse of the price-earning ratio, which is called the earnings yield, can be computed for all firms, including those losing money and is not exposed to the same biases as the price earnings ratio is.

Time Variation in Multiples

As any investor who has tracked the market for any length of time knows, multiples change over time for the entire market and for individual sectors. To provide a measure of how much multiples can change over time, we have computed the average and median PE ratios each year from 2000 to 2008 for the United States in table 4.2:

Table 4.2: PE Ratios across time: US Stocks

	Average	*Median*	% of firms with PE ratios
Jan-00	52.16	24.55	65.33%
Jan-01	44.99	14.74	63.00%
Jan-02	43.44	15.5	57.06%
Jan-03	33.36	16.68	49.99%
Jan-04	41.4	20.76	58.18%
Jan-05	48.12	23.21	56.43%
Jan-06	44.33	22.40	56.89%
Jan-07	40.77	21.21	57.50%
Jan-08	45.02	18.16	56.42%

In the last column, we note the percentage of firms in the overall sample for which we were able to compute PE ratios. Note that the beginning of 2000 was the peak of the market bubble and the high values for the PE ratios attest to this.

Why do multiples change over time? Some of the change can be attributed to fundamentals. As interest rates and economic growth shift over time, the pricing of stocks will change to reflect these shifts; lower interest rates, for instance, played a key role in the rise of earnings multiples through the 1990s. Some of the change, though, comes from changes in market perception of risk. As investors become more risk averse, which tends to happen during recessions, multiples paid for stocks will decrease. This is

captured in figure 4.4, which shows earnings yield (Earnings/Price) ratio for the S&P 500 and the T.bond rate over time.

Figure 4.4: US Market: E/P and Interest Rates: 1960-2007

Note that the earnings yield rose with the treasury bond rate in the 1970s and declined as rates went down in the 1980s and 1990s. From a practical standpoint, what are the consequences? The first is that comparisons of multiples across time are fraught with danger. For instance, the common practice of branding a market to be under or over valued based upon comparing the PE ratio today to historical PE ratios will lead to misleading judgments when interest rates are higher or lower than historical norms. The second is that relative valuations have short shelf lives. A stock may look cheap relative to comparable companies today but that assessment can shift dramatically over the next few months. Intrinsic valuations are inherently more stable than relative valuations.

Analytical Tests

In discussing why analysts were so fond of using multiples, we argued that relative valuations require fewer assumptions than discounted cash flow valuations. While this is technically true, it is only so on the surface. In reality, we make just as many assumptions

when we do a relative valuation as we do in a discounted cash flow valuation. The difference is that the assumptions in a relative valuation are implicit and unstated, whereas those in discounted cash flow valuation are explicit and stated. The two primary questions that we need to answer before using a multiple are: What are the fundamentals that determine at what multiple a firm should trade? How do changes in the fundamentals affect the multiple?

Determinants

In the introduction to discounted cash flow valuation, we observed that the value of a firm is a function of three variables – it capacity to generate cash flows, its expected growth in these cash flows and the uncertainty associated with these cash flows. Every multiple, whether it is of earnings, revenues or book value, is a function of the same three variables – risk, growth and cash flow generating potential. Intuitively, then, firms with higher growth rates, less risk and greater cash flow generating potential should trade at higher multiples than firms with lower growth, higher risk and less cash flow potential.

The specific measures of growth, risk and cash flow generating potential that are used will vary from multiple to multiple. To look under the hood, so to speak, of equity and firm value multiples, we can go back to fairly simple discounted cash flow models for equity and firm value and use them to derive the multiples.

In the simplest discounted cash flow model for equity, which is a stable growth dividend discount model, the value of equity is:

$$\text{Value of Equity} = P_0 = \frac{DPS_1}{k_e - g_n}$$

where DPS_1 is the expected dividend in the next year, k_e is the cost of equity and g_n is the expected stable growth rate. Dividing both sides by the earnings, we obtain the discounted cash flow equation specifying the PE ratio for a stable growth firm.

$$\frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

The key determinants of the PE ratio are the expected growth rate in earnings per share, the cost of equity and the payout ratio. Other things remaining equal, we would expect

higher growth, lower risk and higher payout ratio firms to trade at higher multiples of earnings than firms without these characteristics.

Dividing both sides by the book value of equity, we can estimate the price/book value ratio for a stable growth firm.

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * Payout\ Ratio * (1 + g_n)}{k_e - g_n}$$

where ROE is the return on equity and is the only variable in addition to the three that determine PE ratios (growth rate, cost of equity and payout) that affects price to book equity.

Dividing by the Sales per share, the price/sales ratio for a stable growth firm can be estimated as a function of its profit margin, payout ratio, risk and expected growth.

$$\frac{P_0}{Sales_0} = PS = \frac{Profit\ Margin * Payout\ Ratio * (1 + g_n)}{k_e - g_n}$$

The net margin is the new variable that is added to the process. While all of these computations are based upon a stable growth dividend discount model, we will show that the conclusions hold even when we look at companies with high growth potential and with other equity valuation models.

We can do a similar analysis to derive the firm value multiples. The value of a firm in stable growth can be written as:

$$\text{Value of Firm} = V_0 = \frac{FCFF_1}{k_c - g_n}$$

Dividing both sides by the expected free cash flow to the firm yields the Value/FCFF multiple for a stable growth firm.

$$\frac{V_0}{FCFF_1} = \frac{1}{k_c - g_n}$$

The multiple of FCFF that a firm commands will depend upon two variables – its cost of capital and its expected stable growth rate. Since the free cash flow the firm is the after-tax operating income netted against the net capital expenditures and working capital needs of the firm, the multiples of revenues, EBIT and after-tax EBIT can also be estimated similarly.

$$\frac{V_0}{EBIT_1(1-t)} = \frac{(1 - \text{Reinvestment Rate})}{k_c - g_n}$$

$$\frac{V_0}{EBIT_1} = \frac{(1 - \text{Reinvestment Rate})(1-t)}{k_c - g_n}$$

$$\frac{V_0}{Sales} = \frac{\text{After-tax Operating Margin } (1 - \text{Reinvestment Rate})}{k_c - g_n}$$

Table 4.2 summarizes the multiples and the key variables that determine each multiple, with the sign of the relationship in brackets next to each variable: ⇧ indicates that an increase in this variable will increase the multiple, whereas ⬇ indicates that an increase in this variable will decrease the multiple, holding all else constant.

Table 4.2: Fundamentals Determining Multiples

Multiple	Fundamental Determinants
Price Earnings Ratio	Expected Growth(⇧), Payout(⇧), Risk(⬇)
Price to Book Equity Ratio	Expected Growth(⇧), Payout(⇧), Risk(⬇), ROE(⇧)
Price to Sales Ratio	Expected Growth(⇧), Payout(⇧), Risk(⬇), Net Margin(⇧)
EV to FCFF	Cost of capital(⬇), Growth Rate(⇧)
EV to EBITDA	Expected Growth(⇧), Reinvestment Rate(⬇), Risk(⬇), ROC(⇧), Tax rate(⬇)
EV to Capital Ratio	Expected Growth(⇧), Reinvestment Rate(⬇), Risk(⬇), ROC(⇧)
EV to Sales	Expected Growth(⇧), Reinvestment Rate(⬇), Risk(⬇), Operating Margin(⇧)

The point of this analysis is not to suggest that we go back to using discounted cash flow valuation, but to understand the variables that may cause these multiples to vary across firms in the same sector. If we ignore these variables, we might conclude that a stock with a PE of 8 is cheaper than one with a PE of 12 when the true reason may be that the latter has higher expected growth or we might decide that a stock with a P/BV ratio of 0.7

is cheaper than one with a P/BV ratio of 1.5 when the true reason may be that the latter has a much higher return on equity.

Companion Variable

While the variables that determine a multiple can be extracted from a discounted cash flow model and the relationship between each variable and the multiple can be developed by holding all else constant and asking what-if questions, there is a single variable that dominates when it comes to explaining each multiple (and it is not the same variable for every multiple). This variable, which is called the companion variable, is critical to using multiples wisely in making valuation judgments and can be identified by looking for the variable that best explain differences across firms using a particular multiple.

So, what are the companion variables for the most widely used multiples? To arrive at this judgment, we looked at which of the variables listed in table 4.2 was most useful in explaining differences across firms with each multiple and came up with the following list:

Multiple	Companion variable	Valuation mismatch
PE Ratio	Expected Growth	Low PE stock with high expected growth rate in earnings per share
PBV Ratio	ROE	Low PBV stock with high ROE
PS Ratio	Net Margin	Low PS stock with high net profit margin.
EV/EBITDA	Reinvestment Rate	Low EV/EBITDA stock with low reinvestment needs
EV/Capital	Return on Capital	Low EV/Capital stock with high return on capital.
EV/Sales	After-tax operating margin	Low EV/Sales ratio with a high after-tax operating margin.

Relationship

Knowing the fundamentals that determine a multiple is a useful first step, but understanding how the multiple changes as the fundamentals change is just as critical to using the multiple. To illustrate, knowing that higher growth firms have higher PE ratios

is not a sufficient insight if we are called upon to analyze whether a firm with a growth rate that is twice as high as the average growth rate for the sector should have a PE ratio that is 1.5 times or 1.8 times or 2 times the average price earnings ratio for the sector. To make this judgment, we need to know how the PE ratio changes as the growth rate changes.

A surprisingly large number of valuation analyses are based upon the assumption that there is a linear relationship between multiples and fundamentals. For instance, the PEG ratio, which is the ratio of the PE to the expected growth rate of a firm and widely used to analyze high growth firms, implicitly assumes that PE ratios and expected growth rates are linearly related.

One of the advantages of deriving the multiples from a discounted cash flow model, as was done in the last section, is that we can analyze the relationship between each fundamental variable and the multiple by keeping everything else constant and changing the value of that variable. When we do this, we will find that there are very few linear relationships in valuation.

3. Application Tests

When multiples are used, they tend to be used in conjunction with comparable firms to determine the value of a firm or its equity. But what is a comparable firm? While the conventional practice is to look at firms within the same industry or business, this is not necessarily always the correct or the best way of identifying these firms. In addition, no matter how carefully we choose comparable firms, differences will remain between the firm we are valuing and the comparable firms. Figuring out how to control for these differences is a significant part of relative valuation.

What is a comparable firm?

A comparable firm is one with cash flows, growth potential, and risk similar to the firm being valued. It would be ideal if we could value a firm by looking at how an exactly identical firm - in terms of risk, growth and cash flows - is priced. Nowhere in this definition is there a component that relates to the industry or sector to which a firm belongs. Thus, a telecommunications firm can be compared to a software firm, if the two are identical in terms of cash flows, growth and risk. In most analyses, however, analysts

define comparable firms to be other firms in the firm's business or businesses. If there are enough firms in the industry to allow for it, this list is pruned further using other criteria; for instance, only firms of similar size may be considered. The implicit assumption being made here is that firms in the same sector have similar risk, growth, and cash flow profiles and therefore can be compared with much more legitimacy.

This approach becomes more difficult to apply when there are relatively few firms in a sector. In most markets outside the United States, the number of publicly traded firms in a particular sector, especially if it is defined narrowly, is small. It is also difficult to define firms in the same sector as comparable firms if differences in risk, growth and cash flow profiles across firms within a sector are large. Thus, there are hundreds of computer software companies listed in the United States, but the differences across these firms are also large. The tradeoff is therefore a simple one. Defining an industry more broadly increases the number of comparable firms, but it also results in a more diverse group of companies.

There are alternatives to the conventional practice of defining comparable firms. One is to look for firms that are similar in terms of valuation fundamentals. For instance, to estimate the value of a firm with a beta of 1.2, an expected growth rate in earnings per share of 20% and a return on equity of 40%[4], we would find other firms across the entire market with similar characteristics.[5] The other is consider all firms in the market as comparable firms and to control for differences on the fundamentals across these firms, using statistical techniques.

Controlling for Differences across Firms

No matter how carefully we construct our list of comparable firms, we will end up with firms that are different from the firm we are valuing. The differences may be small

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[4] The return on equity of 40% becomes a proxy for cash flow potential. With a 20% growth rate and a 40% return on equity, this firm will be able to return half of its earnings to its stockholders in the form of dividends or stock buybacks.

[5] Finding these firms manually may be tedious when your universe includes 10000 stocks. You could draw on statistical techniques such as cluster analysis to find similar firms.

on some variables and large on others and we will have to control for these differences in a relative valuation. There are three ways of controlling for these differences:

1. Subjective Adjustments

Relative valuation begins with two choices - the multiple used in the analysis and the group of firms that comprises the comparable firms. In many relative valuation, the multiple is calculated for each of the comparable firms and the average is computed. To evaluate an individual firm, the analyst then compare the multiple it trades at to the average computed; if it is significantly different, the analyst can make a subjective judgment about whether the firm's individual characteristics (growth, risk or cash flows) may explain the difference. Thus, a firm may have a PE ratio of 22 in a sector where the average PE is only 15, but the analyst may conclude that this difference can be justified because the firm has higher growth potential than the average firm in the industry. If, in the judgment of the analyst, the difference on the multiple cannot be explained by the fundamentals, the firm will be viewed as over valued (if its multiple is higher than the average) or undervalued (if its multiple is lower than the average).

The weakness in this approach is not that analysts are called upon to make subjective judgments, but that the judgments are often based upon little more than guesswork. All too often, these judgments confirm their biases about companies.

2. Modified Multiples

In this approach, we modify the multiple to take into account the most important variable determining it – the companion variable. To provide an illustration, analysts who compare PE ratios across companies with very different growth rates often divide the PE ratio by the expected growth rate in EPS to determine a growth-adjusted PE ratio or the PEG ratio. This ratio is then compared across companies with different growth rates to find under and over valued companies.

There are two implicit assumptions that we make when using these modified multiples. The first is that these firms are comparable on all the other measures of value, other than the one being controlled for. In other words, when comparing PEG ratios across companies, we are assuming that they are all of equivalent risk. The other assumption generally made is that that the relationship between the multiples and

fundamentals is linear. Again, using PEG ratios to illustrate the point, we are assuming that as growth doubles, the PE ratio will double; if this assumption does not hold up and PE ratios do not increase proportional to growth, companies with high growth rates will look cheap on a PEG ratio basis.

Illustration 4.1: Comparing PE ratios and growth rates across firms: Beverage Companies

The PE ratios and expected growth rates in EPS over the next 5 years, based on consensus estimates from analysts, for the firms that are categorized as beverage firms are summarized in Table 4.3.

Table 4.3: Beverage Companies

Company Name	Trailing PE	Expected Growth	Standard Deviation	PEG
Andres Wines Ltd. 'A'	8.96	3.50%	24.70%	2.56
Anheuser-Busch	24.31	11.00%	22.92%	2.21
Boston Beer 'A'	10.59	17.13%	39.58%	0.62
Brown-Forman 'B'	10.07	11.50%	29.43%	0.88
Chalone Wine Group Ltd.	21.76	14.00%	24.08%	1.55
Coca-Cola	44.33	19.00%	35.51%	2.33
Coca-Cola Bottling	29.18	9.50%	20.58%	3.07
Coca-Cola Enterprises	37.14	27.00%	51.34%	1.38
Coors (Adolph) 'B'	23.02	10.00%	29.52%	2.30
Corby Distilleries Ltd.	16.24	7.50%	23.66%	2.16
Hansen Natural Corp	9.70	17.00%	62.45%	0.57
Molson Inc. Ltd. 'A'	43.65	15.50%	21.88%	2.82
Mondavi (Robert) 'A'	16.47	14.00%	45.84%	1.18
PepsiCo, Inc.	33.00	10.50%	31.35%	3.14
Todhunter Int'l	8.94	3.00%	25.74%	2.98
Whitman Corp.	25.19	11.50%	44.26%	2.19
Average	*22.66*	*12.60%*	*33.30%*	*2.00*

Source: Value Line

Is Andres Wine under valued on a relative basis? A simple view of multiples would lead us to conclude this because its PE ratio of 8.96 is significantly lower than the average for the industry.

In making this comparison, we are assuming that Andres Wine has growth and risk characteristics similar to the average for the sector. One way of bringing growth into the comparison is to compute the PEG ratio, which is reported in the last column. Based

on the average PEG ratio of 2.00 for the sector and the estimated growth rate for Andres Wine, we obtain the following value for the PE ratio for Andres.

$$PE\ Ratio = 2.00 * 3.50\% = 7.00$$

Based upon this adjusted PE, Andres Wine looks overvalued even though it has a low PE ratio. While this may seem like an easy adjustment to resolve the problem of differences across firms, the conclusion holds only if these firms are of equivalent risk. Implicitly, this approach assumes a linear relationship between growth rates and PE.

3. Statistical Techniques

Subjective adjustments and modified multiples are difficult to use when the relationship between multiples and the fundamental variables that determine them becomes complex. There are statistical techniques that offer promise, when this happens. In this section, we will consider the advantages of these approaches and potential concerns.

Sector Regressions

In a regression, we attempt to explain a dependent variable by using independent variables that we believe influence the dependent variable. This mirrors what we are attempting to do in relative valuation, where we try to explain differences across firms on a multiple (PE ratio, EV/EBITDA) using fundamental variables (such as risk, growth and cash flows). Regressions offer three advantages over the subjective approach:

a. The output from the regression gives us a measure of how strong the relationship is between the multiple and the variable being used. Thus, if we are contending that higher growth companies have higher PE ratios, the regression should yield clues to both how growth and PE ratios are related (through the coefficient on growth as an independent variable) and how strong the relationship is (through the t statistics and R squared).

b. If the relationship between a multiple and the fundamental we are using to explain it is non-linear, the regression can be modified to allow for the relationship.

c. Unlike the modified multiple approach, where we were able to control for differences on only one variable, a regression can be extended to allow for more than one variable and even for cross effects across these variables.

Coca-Cola	44.33	19.00%	35.51%
Coca-Cola Bottling	29.18	9.50%	20.58%
Coca-Cola Enterprises	37.14	27.00%	51.34%
Coors (Adolph) 'B'	23.02	10.00%	29.52%
Corby Distilleries Ltd.	16.24	7.50%	23.66%
Hansen Natural Corp	9.70	17.00%	62.45%
Molson Inc. Ltd. 'A'	43.65	15.50%	21.88%
Mondavi (Robert) 'A'	16.47	14.00%	45.84%
PepsiCo, Inc.	33.00	10.50%	31.35%
Todhunter Int'l	8.94	3.00%	25.74%
Whitman Corp.	25.19	11.50%	44.26%

Source: Value Line Database

Since these firms differ on both risk and expected growth, a regression of PE ratios on both variables is presented.

$$PE = 20.87 - 63.98 \text{ Standard deviation} + 183.24 \text{ Expected Growth} \qquad R^2 = 51\%$$
$$\quad (3.01) \quad (2.63) \qquad\qquad\qquad (3.66)$$

The numbers in brackets are t-statistics and suggest that the relationships between PE ratios and both variables in the regression are statistically significant. The R-squared indicates the percentage of the differences in PE ratios that is explained by the independent variables. Finally, the regression[6] itself can be used to get predicted PE ratios for the companies in the list. Thus, the predicted PE ratio for Coca Cola, based upon its standard deviation of 35.51% and the expected growth rate of 19%, would be:

$$\text{Predicted } PE_{Cisco} = 20.87 - 63.98 \, (0.3551) + 183.24 \, (0.19) = 32.97$$

Since the actual PE ratio for Coca Cola was 44.33, this would suggest that the stock is overvalued, given how the rest of the sector is priced.

If the assumption that the relationship between PE and growth is not linear, we could either run non-linear regressions or modify the variables in the regression to make the relationship more linear. For instance, using the ln(growth rate) instead of the growth rate in the regression above yields a more linear relationship.

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[6] Both approaches described above assume that the relationship between a multiple and the variables driving value are linear. Since this is not always true, you might have to run non-linear versions of these regressions.

Market Regression

Searching for comparable firms within the sector in which a firm operates is fairly restrictive, especially when there are relatively few firms in the sector or when a firm operates in more than one sector. Since the definition of a comparable firm is not one that is in the same business but one that has the same growth, risk and cash flow characteristics as the firm being analyzed, we need not restrict our choice of comparable firms to those in the same industry. The regression introduced in the previous section controls for differences on those variables that we believe cause multiples to vary across firms. Based upon the variables that determine each multiple, we should be able to regress each multiple against the variables that should affect them. Using table 4.2, which lists out the determinants of each multiple, as a guide, we ran market-wide regressions on each of the multiples. The results are summarized in table 4.5:

Table 4.5: Market-wide Regressions of Multiples: US Companies in January 2008
T statistics in brackets below coefficients

Regression	R^2
PE = 2.74 + 142.63 g + 5.67 Payout +0.55 Beta (3.00) (35.40) (4.73) (1.15)	41.8%
PBV= -4.53 + 26.25 g + 0.57 Payout + 0.84 Beta + 23.03 ROE (1.33) (20.75) (1.64) (5.40) (28.37)	64.0%
PS= -2.59 + 20.06 g + 0.06 Payout – 0.05 Beta + 25.36 Net Margin (1.40) (26.40) (0.30) (0.52) (35.83)	57.8%
EV/Capital= -3.92 + 51.16 g + 18.06 ROIC – 2.59 (Debt/Capital) (0.11) (26.42) (20.63) (3.21)	55.5%
EV/Sales = -1.54 + 32.91 g+ 9.33 Operating Margin – 2.99 (Debt/Capital) (8.69) (27.27) (20.00) (6.40)	53.5%
EV /EBITDA= 4.490 + 96.97 g- 9.28 Tax rate + 1.745 ROIC - 1.837 RIR (6.64) (29.21) (5.27) (1.30) (3.38)	44.8%
g = Expected growth rate in EPS for next 5 years (analyst estimates) Payout = Dividends/Earnings ROIC = Return on capital = EBIT (1- tax rate)/ Book value of capital invested ROE = Net Income/ Book value of Equity Debt/Capital = Debt/ (Market value of Equity + Debt) RIR = Reinvestment Rate = (Cap Ex – Depreciation + Chg in WC)/ EBIT (1-t)	

Note that some of the coefficients are of marginal or no significance (with t statistics well below 2) and that not all of the coefficients have the predicted sign (beta has a positive coefficient rather than the predicted negative one in the PE and PBV ratio regressions). The proportion of the variation explained by the independent variables also varies across

multiples, with book value and revenue multiples generally having higher R-squared than earnings multiples. tt is, however, possible that the proxies that we use for risk (beta, debt/capital), growth (expected growth rate in earnings per share), and cash flow (payout, reinvestment rate) may be imperfect and that the relationship may not be linear. To deal with these limitations, we can add more variables to the regression - e.g., the size of the firm may operate as a good proxy for risk.

The first advantage of this market-wide approach over the "subjective" comparison across firms in the same sector, described in the previous section, is that it does quantify, based upon actual market data, the degree to which higher growth or risk should affect the multiples. It is true that these estimates can contain errors, but those errors are a reflection of the reality that many analysts choose not to face when they make subjective judgments. Second, by looking at all firms in the market, this approach allows us to make more meaningful comparisons of firms that operate in industries with relatively few firms. Third, it allows us to examine whether all firms in an industry are under- or overvalued, by estimating their values relative to other firms in the market.

Limitations of Statistical Techniques

Statistical techniques are not a panacea for research or for qualitative analysis. They are tools that every analyst should have access to, but they should remain tools. In particular, when applying regression techniques to multiples, we need to be aware of both the distributional properties of multiples that we talked about earlier in the chapter and the relationship among and with the independent variables used in the regression.

- The fact that multiples are not normally distributed can pose problems when using standard regression techniques. These problems are accentuated with small samples, where the asymmetry in the distribution can be magnified by the existences of a few large outliers.

- In a multiple regression, the independent variables are themselves supposed to be independent of each other. Consider, however, the independent variables that we have used to explain valuation multiples – cash flow potential or payout ratio, expected growth and risk. Across a sector and over the market, it is quite clear that high growth companies will tend to be risky and have low payout. This correlation across

independent variables creates "multicollinearity" which can undercut the explanatory power of the regression.

- Earlier in the chapter, we noted how much the distributions for multiples changed over time, making comparisons of PE ratios or EV/EBITDA multiples across time problematic. By the same token, a multiple regression where we explain differences in a multiple across companies at a point in time will itself lose predictive power as it ages. A regression of PE ratios against growth rates in early 2007 may therefore not be very useful in valuing stocks in early 2008.

- As a final note of caution, the R-squared on relative valuation regressions will almost never be higher than 70% and it is common to see them drop to 30 or 35%. Rather than ask the question of how high an R-squared has to be to be meaningful, we would focus on the predictive power of the regression. When the R-squared decreases, the ranges on the forecasts from the regression will increase. As an example, the beverage sector regression (from illustration 7.3) yields a forecasted PE of 32.97 but the R-squared of 51% generates a range of 27.11 to 38.83 for the forecast with 95% accuracy; if the R-squared had been higher the range would have been tighter.

Reconciling Relative and Intrinsic Valuations

The two approaches to valuation – discounted cash flow valuation and relative valuation – will generally yield different estimates of value for the same firm at the same point in time. It is even possible for one approach to generate the result that the stock is under valued while the other concludes that it is over valued. Furthermore, even within relative valuation, we can arrive at different estimates of value depending upon which multiple we use and what firms we based the relative valuation on.

The differences in value between discounted cash flow valuation and relative valuation come from different views of market efficiency, or put more precisely, market inefficiency. In discounted cash flow valuation, we assume that markets make mistakes, that they correct these mistakes over time, and that these mistakes can often occur across entire sectors or even the entire market. In relative valuation, we assume that while markets make mistakes on individual stocks, they are correct on average. In other words, when we value a new software company relative to other small software companies, we

are assuming that the market has priced these companies correctly, on average, even though it might have made mistakes in the pricing of each of them individually. Thus, a stock may be over valued on a discounted cash flow basis but under valued on a relative basis, if the firms used for comparison in the relative valuation are all overpriced by the market. The reverse would occur, if an entire sector or market were underpriced.

Summary

In relative valuation, we estimate the value of an asset by looking at how similar assets are priced. To make this comparison, we begin by converting prices into multiples – standardizing prices – and then comparing these multiples across firms that we define as comparable. Prices can be standardized based upon earnings, book value, revenue or sector-specific variables.

While the allure of multiples remains their simplicity, there are four steps in using them soundly. First, we have to define the multiple consistently and measure it uniformly across the firms being compared. Second, we need to have a sense of how the multiple varies across firms in the market. In other words, we need to know what a high value, a low value and a typical value are for the multiple in question. Third, we need to identify the fundamental variables that determine each multiple and how changes in these fundamentals affect the value of the multiple. Finally, we need to find truly comparable firms and adjust for differences between the firms on fundamental characteristics.