

CHAPTER 9

VALUE MULTIPLES

While equity multiples focus on the value of equity, enterprise and firm value multiples are built around valuing the firm or its operating assets. Just as we gain more flexibility in dealing with changing and divergent financial leverage when we go from equity to firm valuation in discounted cash flow valuation, firm value multiples are easier to work with than equity multiples, when comparing companies with different debt ratios. In this chapter, we will begin by defining firm and enterprise value multiples and then examine how they are distributed across companies. We will follow up by evaluating the variables that determine each multiple and how changes in these variables affect the multiple. We will close the chapter by looking at applications of enterprise value multiples in a variety of contexts.

Definition of Value Multiples

Value multiples require two inputs – an estimate of the value of a firm or its operating assets in the numerator and a measure of revenues, earnings or book value in the denominator. We will begin by looking at variations on measurement of firm value and at the appropriate and consistent scaling measures for firm value in the second part of the section.

A. Measuring Value

In addition to two issues we confronted when measuring equity value – how best to deal with cash and with equity options – there are two more issues that we face when estimating firm value that relate to how to deal with cross holdings and what to include in debt:

a. Cum-cash or Ex-cash: The conventional measure of firm value is obtained by adding the market value of equity to the market value of debt. However, this firm value measure includes all assets owned by the firm including its cash holdings. Netting cash out from firm value yields enterprise value, which can be considered to be the market value of just the operating assets of the firm.

$$\text{Firm Value} = \text{Market value of Equity} + \text{Market value of Debt}$$

$$\text{Enterprise Value} = \text{Market Value of Equity} + \text{Market value of Debt} - \text{Cash Holdings}$$

There are some analysts who draw a distinction between operating cash and excess cash, with only excess cash being subtracted out to get to enterprise value. The definitions of operating cash vary widely, though, and we would be well served drawing a distinction between wasting and non-wasting cash, with non-wasting cash being cash invested to earn a fair market rate of return. We would net non-wasting cash from debt to get to enterprise value. We will discuss this topic in more detail in chapter 10.

b. Equity Options: When discussing equity value, we noted that the total market value of equity should include the value of equity options issued by the firm, including non-traded management options at an estimated value. The same reasoning applies with firm and enterprise value. If our objective is to estimate the total market value of a firm, we should be adding in the value of equity options to the market capitalization to get to the market value of equity.

c. Cross Holdings: In our discussion of discounted cash flow valuation in chapter 6, we briefly referenced the problems created by cross holdings, a topic we will return to in more depth later in this book. Cross holdings can become an issue when measuring in firm value and enterprise value multiples as well. The total value of a firm will include the estimated market values of both its minority and majority cross holdings in other companies. From a practical standpoint, though, it may be easier to work with the value of just the parent company, obtained by netting out the market values of cross holdings in other companies. There are several common mistakes that analysts make in dealing with cross holdings that can result in misleading conclusions:

- Counting equity portion of minority holdings but not debt and cash: With minority holdings, one common error arises from the fact that the market value of equity of the parent company incorporate the estimated market value of minority holdings in other companies but the debt and cash values do not, since they come from the parent company's balance sheet. If the objective is to count the proportionate share of the subsidiary in which we have the minority holding, we should be consistent. In other words, if the market value of equity of the parent company incorporates a 5% holding in a subsidiary, we should be adding 5% of the company's debt and cash to the debt

and cash that we use to compute enterprise value. If the objective is to strip out the subsidiary entirely, we should be netting out the market value of equity in the subsidiary (from the 5% holding) to obtain the market value of equity in the parent company.

- Adding minority interest from the balance sheet to enterprise value to obtain the total market value of the consolidated company: With majority holdings in other companies, we face a different problem. When a parent company holds 55% of a subsidiary, it is required to fully consolidate its financial statements. As a consequence, the debt and cash that are used to compute enterprise value include 100% of the cash and debt of the subsidiary (rather than just the 55% holding) but the market value of equity is reflective of only the 55% of the equity. To include the value of the 45% of the equity that is not being considered, many analysts add minority interests (which is the accountant's measure of the value of the 45% held by others) to enterprise value. The problem, however, with minority interests is that it is in book value terms and will usually understate the market value of equity in the subsidiary. As in discounted cash flow valuation, estimating a market value for the minority interests and adding it to the enterprise value will provide a better measure of overall value.

In summary, the consolidated value of a company, including the total value of its cross holdings can be obtained by doing the following:

$$\text{Enterprise Value}_{\text{With cross holdings}} = \text{Market Value of Equity}_{\text{Consolidated}} + \text{Market Value of Debt}_{\text{Consolidated}} - \text{Cash}_{\text{Consolidated}} + \sum_{j=1}^{j=n} \pi_j (\text{Debt}_j - \text{Cash}_j) + \sum_{k=1}^{k=n} \text{Market Value of Minority Interest}_k$$

The first additional term in the equation adds in the proportional holdings (π_j) of net debt in the minority holdings (j holdings) whereas the second term brings in the full value of equity in majority holdings (k holdings). A far easier solution is to compute enterprise value without cross holdings:

$$\text{Enterprise Value}_{\text{No cross holdings}} = \text{Market Value of Equity}_{\text{Consolidated}} + \text{Market Value of Debt}_{\text{Consolidated}} - \text{Cash}_{\text{Consolidated}} -$$

$$\sum_{j=1}^{j=n} \pi_j (\text{Market Value of Equity}_j) - \sum_{k=1}^{k=n} (\text{Market Value of Majority Holding}_k + \text{Debt}_k - \text{Cash}_k)$$

The first additional term in the equation nets out the estimated market value of equity of minority holdings, whereas the second term eliminates the effects of majority holdings by subtracting out the estimated market value of the holding and the consolidated debt and cash from the cross holding.

d. Measuring Debt: In the discounted cash flow valuation, we developed two sets of rules for debt. When computing cost of capital, we pushed for a narrow definition of debt where we considered only interest bearing debt and lease commitments. In going from firm value to equity value, we posited that we should include other potential liabilities such as under funded pension and health care obligations. In both cases, we argued that the market value of debt was the more legitimate measure of debt. When computing enterprise value, we will hew closer to the second definition than the first one and argue for inclusion of other potential liabilities in debt. We also believe that, notwithstanding conventional practice, using market value of debt (even when it is estimated) is a better practice than using book value of debt.

Illustration 9.1: Estimates of Firm and Enterprise Value

In this illustration, we will estimate firm and enterprise value measures for Segovia, a firm with two holdings – a 60% stake in Seville Television and a 10% stake of LatinWorks, a record and CD company. The first holding is categorized as a majority, active holding (resulting in full consolidation) and the second as a minority holding. Here, we will try to estimate measures of firm value for Seville, using the following information.

- The market value of equity at Segovia is \$1,500 million, the consolidated debt outstanding at the firm is \$500 million and the consolidated cash balance is \$150 million. A portion of the debt outstanding (\$150 million) and the cash balance (\$50 million) is attributable to Seville Television. The minority interest in Seville is shown in Segovia's balance sheet at \$ 120 million.
- Seville Television is a publicly traded firm with a market value of equity of \$600 million.
- LatinWorks is a private firm with an estimated value for equity of \$ 400 million; the firm has \$100 million in debt outstanding and \$ 25 million as a cash balance.

If we estimate the enterprise and firm value for Segovia using its consolidated financial statements, we would obtain the following.

$$\begin{aligned}\text{Firm Value} &= \text{Market Value of Equity} + \text{Debt} \\ &= 1500 + 500 = \$2,000 \text{ million}\end{aligned}$$

$$\begin{aligned}\text{Enterprise Value} &= \text{Market Value of Equity} + \text{Debt} - \text{Cash} \\ &= 1500 + 500 - 150 = \$1,850 \text{ million}\end{aligned}$$

This value is contaminated because the market value of equity reflects the 60% holding in Seville and the 10% stake in LatinWorks, but the debt and the cash include 100% of Seville's holdings and none of the same for LatinWorks.

The conventional way of adjusting at least for the majority holding is to add back the book value of minority interest to ostensibly bring in the other equity investor's interests in the holding.

$$\begin{aligned}\text{Enterprise Value} &= \text{Market Value of Equity} + \text{Debt} - \text{Cash} + \text{Minority Interests} \\ &= 1500 + 500 - 150 + 120 = \$1,970 \text{ million}\end{aligned}$$

If this is supposed to measure the combined values of the parent and the subsidiary, it falls short because the accounting measure of the minority interest does not match up to the market value. In fact, to adjust for the full market value of the minority interests, we would have to do the following:

$$\begin{aligned}\text{Enterprise Value}_{\text{Consolidated}} &= \text{Market Value of Equity} + \text{Debt} - \text{Cash} + \text{Market Value of} \\ \text{Minority Interests} &= 1500 + 500 - 150 + .40(600) = \$2,090 \text{ million}\end{aligned}$$

Note that we are using the market value of equity of the consolidated subsidiary; if it had been a private business, we would have had to estimate the market value of the firm.

This measure of enterprise value includes the minority holding in LatinWorks. If we want to exclude that holding, we would have to net out the estimated value from the measure:

$$\begin{aligned}\text{Enterprise Value}_{\text{Consolidated but without minority holdings}} &= \text{Enterprise Value}_{\text{Consolidated}} - \text{Market} \\ \text{Value of Minority Holdings} &= 2,090 - .1(400) = \$2,050 \text{ million}\end{aligned}$$

Again, we are using the estimated market value of equity of LatinWorks in this calculation.

Finally, we can also estimate the enterprise value of just the parent company by eliminating all of the majority holding's effects on enterprise value:

$$\text{Enterprise Value}_{\text{Parent}} = \text{Enterprise Value}_{\text{Consolidated but without minority holding}} - \text{Enterprise Value}_{\text{Subsidiary}} = 2,050 - (600 + 150 - 50) = \$1,350 \text{ million}$$

B. Scaling Variable

The consistency principle requires us to scale firm value to variables related to the firm, rather than equity. In general, these variables can be categorized into earnings, book value, revenue and activity variables. In this section, we will consider our choices.

a. Earnings Variables: When scaling equity value, we used measures of equity earnings such as net income and earnings per share. To scale firm or enterprise value, the measures of earnings that we use have to relate to the entire firm. There are three measures of operating earnings that are potential candidates:

a. Earnings before interest, taxes, depreciation and amortization (EBITDA): This can be considered an approximate measure of the cash flow generated by the operating assets of the firm, prior to taxes and reinvestment needs.

b. Earnings before interest and taxes (Operating Income): This is a more conventional measure of accounting earnings from operating assets, albeit prior to taxes.

c. Earning before interest but after taxes (After-tax Operating Income): This converts the operating income into an after tax value.

All three of these measures are prior to earnings from cash holdings and income from minority holdings in other companies. If the measures of earnings that we use are just for the parent company (and thus unconsolidated), the measure of value that we use should reflect only the parent company and should net out not only the cash holdings but also the value of all cross holdings, minority as well as majority. When working with consolidated earnings, we should use a measure of firm value that nets out cash and minority holdings, but includes the entire majority holding. Table 9.1 summarizes the choices:

Table 9.1: Value Measures and Earnings from Operations

<i>Earnings Measure</i>	<i>Value Measure</i>
Unconsolidated	Enterprise value of just parent company = Market Value of Equity _{Parent}

after-tax operating income, operating income or EBITDA	$+ \text{Market Value of Debt}_{\text{parent}} - \text{Cash}_{\text{parent}} - \sum_{j=1}^{j=n} \pi_j (\text{Market Value of Equity}_j) - \sum_{k=1}^{k=n} (\text{Market Value of Majority Holding}_k + \text{Debt}_k - \text{Cash}_k)$
Consolidated after-tax operating income, operating income or EBITDA	$\text{Enterprise value of consolidated company} = \text{Market Value of Equity}_{\text{parent}} + \text{Market Value of Debt}_{\text{parent}} - \text{Cash}_{\text{parent}} - \sum_{j=1}^{j=n} \pi_j (\text{Market Value of Equity}_j) + \sum_{k=1}^{k=n} \text{Market Value of Minority Interest}_k$

If we choose to leave the value of minority holdings in enterprise value (as many analysts choose to do), we have to count the proportionate share of the subsidiaries' cash, debt and operating income when computing multiples. That can prove to be a daunting exercise, especially when there are dozens of cross holdings.

b. Book Value Variables: When computing price to book equity ratios, we used the book value of equity as our starting point. When computing value multiples, we should work with the book value of capital, though we may make adjustments for cash holdings and holdings in other companies. Table 9.2 summarizes our choices:

Table 9.2: Value Measures and Book Value

<i>Book Value Measure</i>	<i>Value Measure</i>
Book value of capital = Book value of Equity + Book value of Debt	Firm Value = Market Value of Equity + Market Value of Debt
Book value of non-cash (invested) capital = Book value of equity + Book value of Debt – Cash	Enterprise Value = Market Value of Equity + Market Value of Debt - Cash
Book value of consolidated capital = Book value of equity + Book value of Debt – Cash + Minority Interests (Book value)	Enterprise Value = Market Value of Equity + Market Value of Debt – Cash + Market value of Minority Interests

In each case, note that we are including in the book value only those items that are also included in market value measure. That is why the book value of assets cannot be used in conjunction with enterprise value or firm value and is better matched up with the estimated market value of total assets.

c. Revenues: In the chapter on equity multiples, we noted that price to sales ratios, where the market value of equity is divided by total revenues, is inconsistently defined. Since revenues are generated for the entire business, a much more consistent version of the multiple would be obtained by dividing enterprise value by total revenues. As with earnings, though, cross holdings in other companies can skew this multiple and the following adjustments are in order:

- The estimated market value of minority holdings in other firms should be subtracted out from the market value of equity to arrive at the enterprise value, since the revenues from these minority holdings are not considered when computing the parent company's revenues.
- In the event there are majority holdings that are fully consolidated, we should add back the market value of minority interests to the enterprise value to arrive at the composite value of the firm that can then be scaled to the total revenues of the firm (which will include the revenues from the subsidiary). Alternatively, we can focus on just the parent company's enterprise value and revenues.

d. Activity Variables: The final set of variables that relate to firm performance are derived from variables that measure operating activity ranging from units produced to number of customers. Thus, the market value of a cable firm can be divided by the number of subscribers to arrive at market value per cable subscriber. In the late 1990s, a number of internet companies were valued based upon multiples of web site visitors or even as a multiple of how much time was spent looking at the web sites. In general, the measure of value that makes the most sense for use with activity variables is enterprise value, where cash is netted out from the market value of debt and equity.

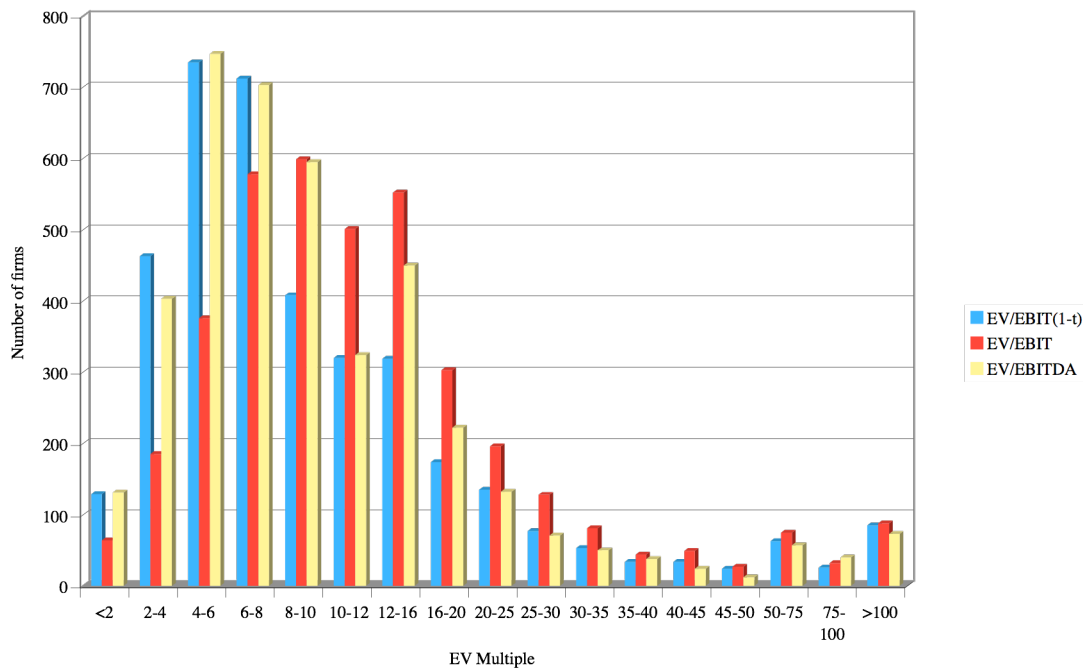
Distributional Characteristics of Value Multiples

Enterprise value multiples, like the equity multiples that we examined in the last chapter, have wide ranges, with some firms trading at extremely high multiples. Like equity multiples, they are constrained to be greater than zero, thus creating the distributions skewed towards large positive values.

a. Value/ Operating Earnings Multiples

To get a better measure of the distributional characteristics of value multiples, we will begin by looking at multiples of operating income in Figure 9.1. In this figure, we look at enterprise value as a multiple of EBITDA, operating income and after-tax operating income for firms in the United States in January 2006.

Figure 9.1: EV/ Operating Income Multiples



We follow up by reporting the statistical properties of each of these multiples in table 9.3, starting with the average and median but also including the 10th and 90th percentiles of the distribution.

Table 9.3: Distributional Characteristics – EV/ Operating Income Multiples

	<i>EV/ EBIT (1-t)</i>	<i>EV/EBIT</i>	<i>EV/EBITDA</i>
Mean	29.55	24.73	21.18

Standard Error	1.69	3.18	3.35
Median	12.72	10.49	8.09
Standard Deviation	142.61	196.34	212.32
Count	3816	3816	4018
Minimum Value	0.45	0.60	0.60
Maximum Value	6155.15	5130.46	4984.22
90th percentile	34.72	29.38	23.37
10th percentile	5.16	4.90	3.36

Like the equity earnings multiples described in the last chapter, multiples of operating income have large positive outliers, pushing the average values well above the median values.

Looking at the distributions of value multiples also provide us with a simple way of testing and debunking widely used rules of thumb in investing and portfolio management. One rule of thumb used in acquisitions and portfolio management is that firms that trade at less than 7 times EBITDA are cheap. The fact that there are almost 1500 firms in the United States that trade at less than 7 times EBITDA should cast doubt on this rule of thumb.

There is one final point worth making about operating income multiples in general and EBITDA multiples in particular. Far fewer firms have negative EBITDA than have negative earnings per share or net income. Since earnings multiples cannot be computed for these firms, there is less potential for bias with EBITDA multiples than with PE ratios. This is especially true for companies in heavy infrastructure sectors (telecom, cable and cellular firms), where depreciation is a large expense item.

b. Value/ Book Capital

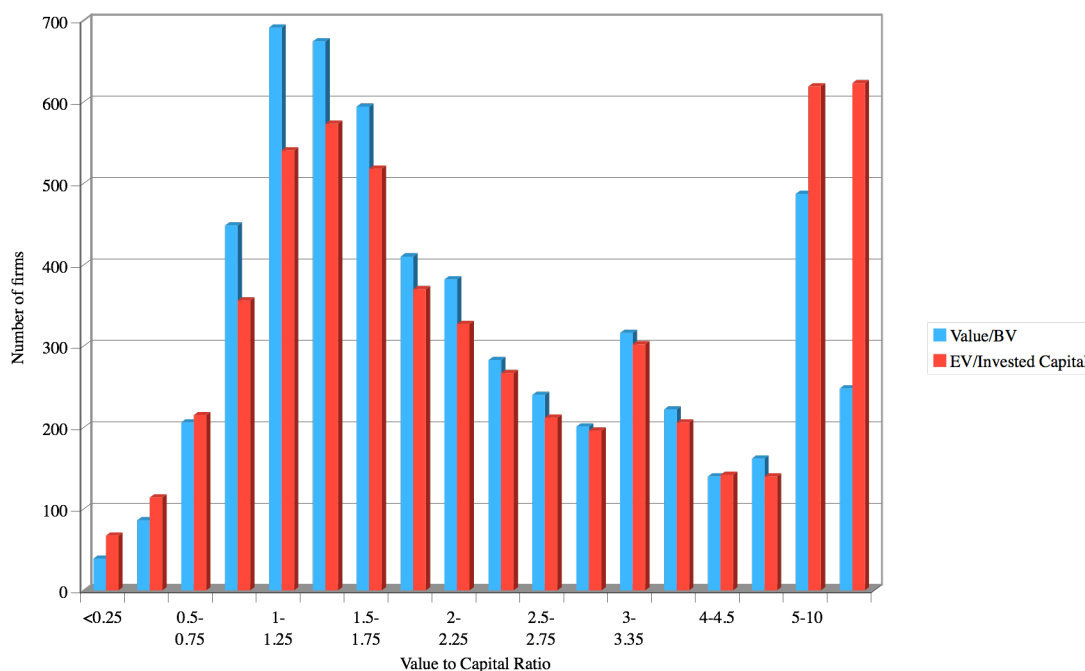
The value to book capital ratio can be computed in two different ways, one with cash treated as part of capital and one without:

$$\text{Value/Book Capital} = \frac{(\text{Market Value of Equity} + \text{Market Value of Debt})}{(\text{Book Value of Equity} + \text{Book Value of Debt})}$$

$$\text{EV/Invested Capital} = \frac{(\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash})}{(\text{Book Value of Equity} + \text{Book Value of Debt} - \text{Cash})}$$

In figure 9.2, we look at the distribution of value to book capital and enterprise value to net book capital.

Figure 9.2: BV/Capital and EV/Invested Capital - US Firms in January 2006



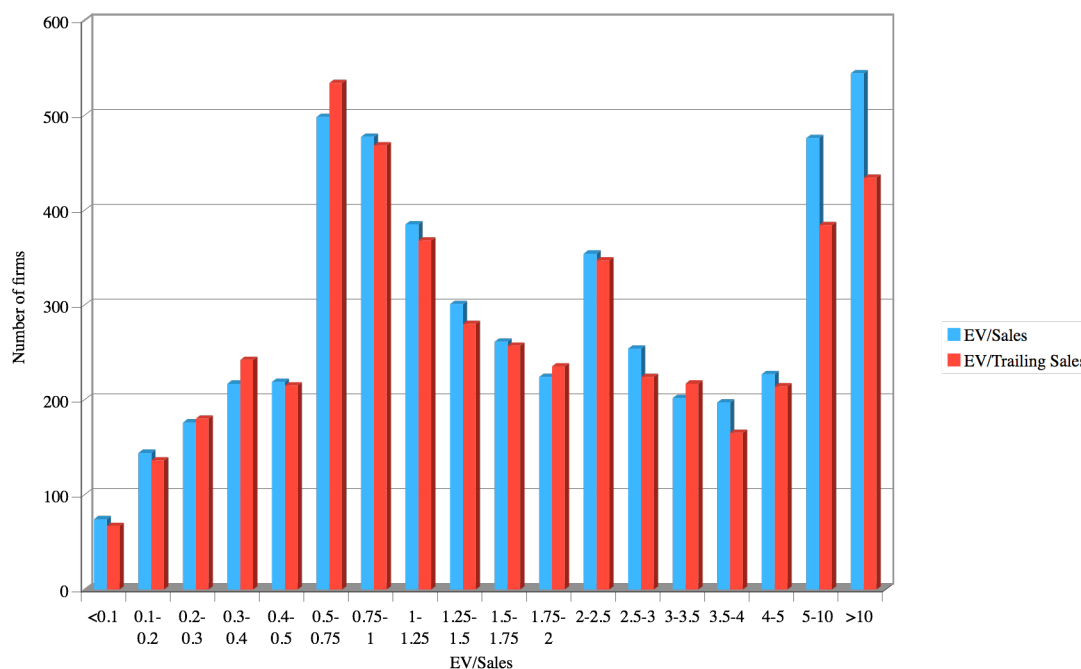
As with the other multiples, it is a heavily skewed distribution. The median value to book ratio is 1.83 while the median EV/Invested capital ratio is 2.06. Both are slightly lower than the median price to book ratio computed for the same firms. While the two distributions are similar in many respects, the enterprise value to net book capital ratios tend to have lower average and median values than value to book capital ratios.

One of the interesting by-products of switching from price to book ratios to value to book is that we lose no firms in the sample. In other words, the book value of equity can be negative but the book value of capital is always positive. The invested capital, computed by netting cash out against the book value of capital, is negative for firms where the cash balance exceeds the book value of capital.

c. Enterprise Value/ Revenues

In chapter 8, we looked at the distribution of price to sales ratios. In figure 9.3, we report on the multiple of enterprise value to revenues in the most recent financial year and revenues over the last four quarters (trailing revenues).

Figure 9.3: EV/Sales Ratios - US Firms in January 2006



Not surprisingly, enterprise value to sales ratios tend to have higher values than price to sales ratios for most firms, since debt outstanding exceeds cash at these firms. There are some firms, especially in the technology sector, which have considerable cash holdings and little or no debt. For these firms enterprise value to sales ratios are lower than price to sales ratios. The median EV/Sales ratio for the entire market is 1.58, with substantial variation across sectors. To illustrate, the top decile of all U.S. firms has EV/Sales ratios that exceed 15 while the bottom decile has EV/Sales ratios that are lower than 0.25.

Analysis of Value Multiples

To understand the determinants of value multiples, we will follow a process very similar to the one that we devised to examine equity multiples. There, we began with a dividend discount model and used it to derive the PE, price to book and price to sales ratios. In the case of value multiples, we will begin with a firm valuation model, where we discount cash flows to the firm at the cost of capital, and examine the determinants of each multiple.

Determinants of Value Multiples

With equity multiples, we showed that the determinants of multiples don't change as we go from stable growth to two-stage models, though there are more estimation requirements with the latter. Since stable growth models are much easier to work with than high growth models, we will derive the determinants of value multiples using a stable growth firm valuation model:

$$\text{Enterprise Value} = \frac{\text{Free Cashflow to Firm}_{\text{next year}}}{(\text{Cost of Capital} - \text{Expected Growth Rate})}$$

Drawing on our earlier discussion of free cash flow to the firm (in chapter 3), the free cash flow to the firm (FCFF) can be written in terms of after-tax operating income and the reinvestment rate:

$$\text{Enterprise Value} = \frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - \text{Expected Growth Rate})}$$

Using g as our measure of the expected growth rate, we can now easily derive the equations for enterprise value as multiples of next year's operating income (EBIT) and after-tax operating income (EBIT (1-tax rate)).

$$\frac{\text{Enterprise Value}}{\text{EBIT}_{\text{next year}}} = \frac{(1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

$$\frac{\text{Enterprise Value}}{\text{EBIT}_{\text{next year}} (1 - \text{tax rate})} = \frac{(1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

If we want to specify enterprise value as a multiple of this year's operating income, the equations will be modified to include a one-year growth term in the numerator:

$$\frac{\text{Enterprise Value}}{\text{EBIT}_{\text{this year}}} = \frac{(1 + g) (1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

$$\frac{\text{Enterprise Value}}{\text{EBIT}_{\text{this year}} (1 - \text{tax rate})} = \frac{(1 + g)(1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

Other things remaining equal, both EV/EBIT and EV/EBIT (1-t) will increase as the growth rate increases and the cost of capital decreases. They will both also increase as the reinvestment rate decreases (for any given growth rate). However, given our earlier discussion of growth being a product of the return on capital and the reinvestment rate,

this is equivalent to stating that the enterprise value multiples will increase as the return on capital increases, holding all other variables fixed.

To analyze EV/EBITDA multiples, we will begin by stating the free cashflow to the firm in terms of EBITDA:

Free Cashflow to the Firm = EBIT (1- t) – (Cap Ex – Depreciation) – Chg in Working capital = EBITDA (1-t) + Depreciation (t) – Cap Ex – Chg in Working Capital

Substituting this equation with inputs for the next year into the stable growth firm valuation model, we get:

$$\text{Enterprise Value} = \frac{\text{EBITDA}_1(1-t) + \text{Depreciation}_1(t) - \text{Cap Ex}_1 - \text{Chg in WC}_1}{(\text{Cost of Capital} - g)}$$

Dividing through by EBITDA yields the determinants of the EV/EBITDA multiples

$$\frac{\text{EV}}{\text{EBITDA}_1} = \frac{(1-t) + \frac{(\text{Depreciation}_1(t) - \text{Cap Ex}_1 - \text{Chg in WC}_1)}{\text{EBITDA}_1}}{(\text{Cost of Capital} - g)}$$

We can simplify this further, if we consolidate the reinvestment terms:

Reinvestment = Cap Ex – Depreciation + Chg in Working Capital

$$\frac{\text{EV}}{\text{EBITDA}} = \frac{(1-t) - \frac{\text{Reinvestment}}{\text{EBITDA}_1} - \frac{\text{Depreciation}(1-t)}{\text{EBITDA}}}{(\text{Cost of Capital} - g)}$$

In other words, the EV/EBITDA multiple is a function of the same variables that determine the operating earnings multiples, with companies with higher growth, lower cost of capital and higher return on capital (which pushed down reinvestment) trading at higher multiples of EBITDA. In addition, firms with significant depreciation charges should trade at lower multiples of EBITDA than otherwise similar firms (in terms of growth, cost of capital and reinvestment) without this depreciation.

As a final note, the pre-tax earnings multiples (EBIT and EBITDA) are also affected by the tax rate, with higher tax rates translating into lower multiples of pre-tax earnings. As a consequence, we would expect companies incorporated and trading in higher tax locales to trade at lower multiples of EBITDA than companies in lower tax locales.

To understand the determinants of value to book ratios, let us revert again to the stable growth model:

$$\text{Enterprise Value} = \frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

Dividing both sides of the equation by the book value of capital, we obtain the following:

$$\frac{\text{EV}}{\text{Book Value of Capital}} = \frac{\frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate})}{\text{Book Value of Capital}} (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

We substitute in the following proxies for return on capital and reinvestment into this equation:

$$\text{Return on capital} = \frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate})}{\text{Book Value of Capital}}$$

$$\text{Reinvestment Rate} = g / \text{Return on Capital}$$

The EV/ Book Capital ratio can now be written as:

$$\frac{\text{EV}}{\text{Book Value of Capital}} = \frac{\text{ROC} - g}{\text{Cost of Capital} - g}$$

In other words, the multiple of book capital that a firm trades at will be an increasing function of two variables – the excess return that the firm earns on its capital invested (ROC – Cost of Capital) and the expected growth rate.

To analyze value to sales multiples, let us repeat the process, again starting with the stable growth firm valuation model:

$$\text{Enterprise Value} = \frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

Dividing both sides by the revenues, we obtain:

$$\frac{\text{EV}}{\text{Sales}} = \frac{\frac{\text{EBIT}_{\text{next year}} (1 - \text{tax rate})}{\text{Sales}} (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)} = \frac{\text{After-tax Operating Margin} (1 - \text{Reinvestment Rate})}{(\text{Cost of Capital} - g)}$$

The enterprise value to sales ratio, in addition to increasing with growth and decreasing as the cost of capital increases will increase as the after-tax operating margin increases.

All of these multiples can be expanded to cover a high growth period, using the following two-stage firm valuation model:

$$V_0 = \frac{(EBIT_0)(1-t)(1-RIR)(1+g) \left(1 - \frac{(1+g)^n}{(1+k_{c,hg})^n} \right)}{k_{c,hg} - g} + \frac{(EBIT_0(1-t))(1-RIR_n)(1+g)^n(1+g_n)}{(k_{c,st} - g_n)(1+k_{c,hg})^n}$$

where RIR is the reinvestment rate and k_c is the cost of capital for the firm with potentially different values for the high growth and stable growth periods. As with the equity multiples, all that will be required is that the variables be estimated twice – once for the high growth and once for the stable growth phase. For instance, the EV/Capital ratio for a high growth firm can be written as:

$$\frac{Value_0}{BV_0} = (ROC_{hg}) \frac{(1-RIR_{hg})(1+g) \left(1 - \frac{(1+g)^n}{(1+k_{c,hg})^n} \right)}{k_{c,hg} - g} + (ROC_{st}) \frac{(1-RIR_{st})(1+g)^n(1+g_n)}{(k_{c,st} - g_n)(1+k_{c,hg})^n}$$

where ROC is the return on capital, estimated for the high growth (hg) and stable growth periods (st).

Illustration 9.2: Estimating Value Multiples for a Firm

Assume that you are computing the multiples of firm value for a firm with the following characteristics:

- In the most recent financial year, the firm reported depreciation of \$ 20 million and earnings before interest and taxes (operating income) of \$ 100 million on revenues of \$ 1 billion; the tax rate was 40%. The resulting after-tax operating margin is 6.00%.
After-tax operating margin = EBIT (1-t)/ Revenues = 100 (1-.4)/1000 = 6%
- The capital invested in the firm was \$ 400 million, translating into an after-tax return on capital of 15%,
After-tax return on capital = EBIT (1-t)/ Capital invested = 100 (1-.4)/400 = 15%
The firm expects to maintain this return on capital in perpetuity.
- The firm expects to reinvest 60% of its after-tax operating income back into the business every year for the next five years, resulting in an expected growth rate of 9% each year:
Expected Growth Rate = Reinvestment Rate * Return on capital = .6*15% = 9%

- The cost of capital is 10% in perpetuity and the expected growth rate after year 5 will be 4%. Given the return on capital of 15%, this translates into a stable period reinvestment rate of 26.67%:

$$\text{Stable period reinvestment rate} = g/\text{ROC} = 4\%/15\% = 26.67\%$$

We can now derive the enterprise value multiples for this firm, using the equations developed in the previous section. Let us begin by estimating the enterprise value for this firm, using the two-stage model developed towards the end of the last section.

$$\text{Value} = \frac{(100)(1-.4)(1-.6)(1.09)\left(1 - \frac{(1.09)^5}{(1.10)^5}\right)}{.10-.09} + \frac{(100(1-.4))(1.09)^5(1-.2667)(1.04)}{(.10-.04)(1+.10)^5} = \$845.39 \text{ million}$$

Dividing this estimate of value by operating income, EBITDA, book capital and revenues yields the enterprise value multiples for this firm:

$$\text{EV/EBITDA} = \$845.39/\$120 = 7.04$$

$$\text{EV/EBIT} = \$845.39/\$100 = 8.45$$

$$\text{EV/EBIT} (1-t) = \$845.39/(\$100(1-.4)) = 14.09$$

$$\text{EV/ Capital Invested} = \$845.39/\$400 = 2.11$$

$$\text{EV/ Sales} = \$845.39/1000 = 0.8454$$

Relationship between Multiples and Fundamentals

In the last section, we used a firm valuation model to back out the variables that determine each multiple and provided a simple illustration with a hypothetical company. In this section, we will explore the relationship between the financial fundamentals and each of the enterprise value multiples using the hypothetical company described in illustration 9.2.

a. The Growth Effect

Holding all other variables constant, increasing the expected growth rate in operating income will increase enterprise value multiples. In table 9.4, we summarize the effect of changing the expected growth rate during the high growth period for the firm in illustration 9.2:

Table 9.4: Expected Growth Rate and EV Multiples

<i>Growth rate during high growth period</i>	<i>EV/EBITDA</i>	<i>EV/EBIT</i>	<i>EV/EBIT (1-t)</i>	<i>EV/Capital</i>	<i>EV/ Revenues</i>
0%	4.70	5.65	9.41	1.41	0.56
2%	5.16	6.19	10.32	1.55	0.62
4%	5.65	6.78	11.30	1.69	0.68
6%	6.18	7.41	12.35	1.85	0.74
8%	6.75	8.09	13.49	2.02	0.81
10%	7.36	8.83	14.71	2.21	0.88
12%	8.01	9.61	16.02	2.40	0.96
14%	8.71	10.46	17.43	2.61	1.05
16%	9.46	11.36	18.93	2.84	1.14
18%	10.27	12.32	20.54	3.08	1.23
20%	11.13	13.35	22.26	3.34	1.34

As the expected growth rate during the high growth period increases, the enterprise value to EBITDA multiple climbs from 4.70 (when the expected growth rate is zero) to 11.13 if the expected growth rate is 20%. The effect is similar in the other multiples as well. The implications of this finding are straightforward. Comparing EV multiples across companies in a sector with widely divergent growth rates will tend to bias analysts towards finding lower growth companies to be under valued (because they will look cheap) and higher growth companies to be over valued, unless they explicitly control for differences in growth.

In the chapter on equity multiples, we also looked at the sensitivity of multiples to the length of the growth period. Rather than repeat that exercise, we will restate the conclusions in terms of enterprise value multiples. Holding other variables constant, being able to maintain high growth with excess returns for a longer period will increase enterprise value multiples. As a consequence, we would expect companies with stronger and more sustainable competitive advantages to trade at higher enterprise value multiples than firms without these advantages.

b. The Risk Effect

Risk affects enterprise value multiples in two ways. One is through the risk and the cost of equity and the other is by way of the debt ratio and the cost of debt. Mature firms with low default and operating risk will be able to borrow substantial amounts at a

low cost without putting too much upward pressure on their costs of equity. As a result, they will enjoy low costs of capital. Risky companies will not only have high costs of equity but also high costs of debt if they borrow, resulting in high costs of capital.

The simplest way to see the effect of risk on enterprise value multiples is therefore through the cost of capital. Returning to illustration 9.2 and holding all other variables fixed, we examined the effect of changing the cost of capital on enterprise value multiples in table 9.5:

Table 9.5: Cost of Capital and Enterprise Value Multiples

<i>Cost of capital</i>	<i>EV/EBITDA</i>	<i>EV/EBIT</i>	<i>EV/EBIT (1-t)</i>	<i>EV/Capital</i>	<i>EV/ Revenues</i>
6%	23.01	27.61	46.02	6.90	2.76
7%	15.00	18.00	30.00	4.50	1.80
8%	11.01	13.21	22.02	3.30	1.32
9%	8.63	10.35	17.25	2.59	1.04
10%	7.04	8.45	14.09	2.11	0.85
11%	5.92	7.11	11.84	1.78	0.71
12%	5.08	6.10	10.17	1.53	0.61
13%	4.44	5.32	8.87	1.33	0.53
14%	3.92	4.71	7.85	1.18	0.47
15%	3.51	4.21	7.01	1.05	0.42

As the cost of capital increases, enterprise values decrease dramatically across the board. Thus, a firm with an expected growth rate of 9% can expect to trade at 23 times EBITDA, if its cost of capital is 6%, but at only 3.5 times EBITDA if the cost of capital rises to 15%.

There are three implications for analysts using enterprise value multiples in relative valuation. The first is that companies in riskier businesses (even within the same sector) will trade at lower enterprise value multiples than more mature and safer companies with predictable sources of income. The second is that differences in financial leverage can affect enterprise value multiples indirectly, especially if some firms are close to their optimal financial leverage whereas others are under or over levered. The latter will have higher costs of capital and lower enterprise value multiples. The third is that comparing companies in emerging markets with companies in developed markets can be skewed by the fact that the former are riskier and have higher costs of capital than the latter. Consequently, they should trade at lower enterprise value multiples.

c. The Quality of Investments Effect

While the growth rate matters, the quality of that growth matters even more. With enterprise value multiples, the quality of growth is best captured by the return on capital. For any given growth rate, a higher return on capital translates into a lower reinvestment rate and higher cash flows to investors, thus pushing up value. In table 9.6, we examine the impact of changing the return on capital while keeping the expected growth rate and the cost of capital fixed in illustration 9.2:

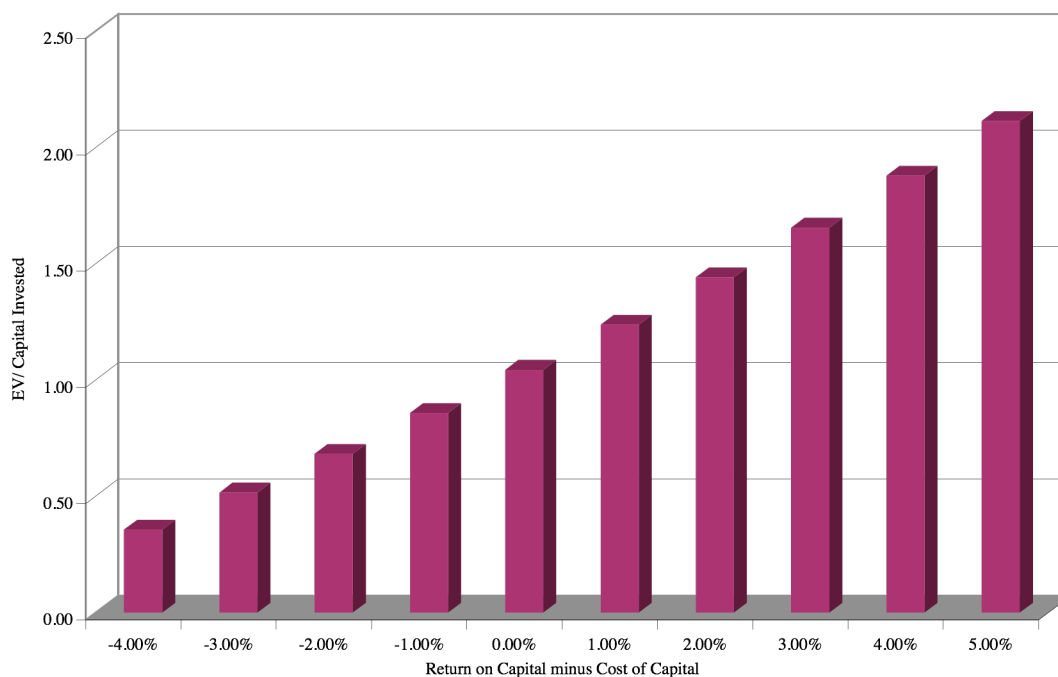
Table 9.6: Return on Capital and EV Multiples

Return on capital	EV/EBITDA	EV/EBIT	EV/EBIT (1-t)	EV/Capital	EV/Revenues
6%	2.98	3.58	5.96	0.36	0.36
7%	3.69	4.42	7.37	0.52	0.44
8%	4.27	5.12	8.54	0.68	0.51
9%	4.77	5.72	9.54	0.86	0.57
10%	5.22	6.26	10.43	1.04	0.63
11%	5.62	6.75	11.25	1.24	0.67
12%	6.01	7.21	12.01	1.44	0.72
13%	6.37	7.64	12.73	1.65	0.76
14%	6.71	8.05	13.42	1.88	0.81
15%	7.04	8.45	14.09	2.11	0.85

Note that the reinvestment rate needed to sustain a given growth rate (9%) increases as the return on capital decreases. At a 6% return on capital, for example, the reinvestment rate in the first 5 years is 150% (to get to a 9% growth rate) and after year 5 is 66.67% (to sustain the stable growth rate of 4%). As the return on capital increases, the enterprise value multiples increase as well.

The enterprise value to invested capital ratio, in particular, is heavily dependent upon the excess return earned by the firm, with excess return defined as the difference between return and cost of capital. Figure 9.4 summarizes the effect of changing the excess return on the enterprise value to invested capital ratio:

Figure 9.4: EV/ Capital Invested versus Excess Returns



As with price to book ratios, the relationship is clear. When excess returns are positive, i.e. the return on capital exceeds the cost of capital, the enterprise value to invested capital ratio is greater than one. When the return on capital is less than the cost of capital, firms will trade below book capital.

The discussion can also be reframed around the after-tax operating margin, since changing the margin while holding the sales to capital ratio fixed will change the return on capital:

$$\text{Return on Capital} = \text{After-tax Operating Margin} * \text{Sales/ Invested Capital}$$

If we change the after-tax operating margin in illustration 9.2, while holding the sales to capital ratio and expected growth rate fixed, the enterprise value multiples will change as shown in table 9.7:

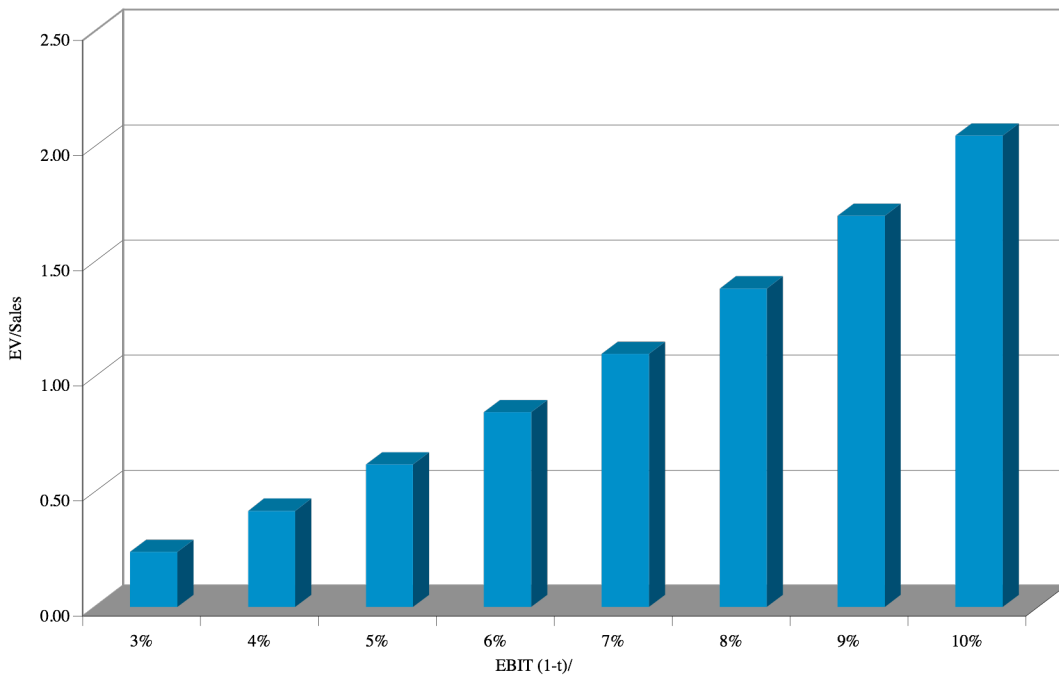
Table 9.7: After-tax Operating Margin and Enterprise Value Multiples

After-tax Operating Margin	Imputed ROC	EV/EBITDA	EV/EBIT	EV/EBIT (1-t)	EV/Capital	EV/ Revenues
3%	7.50%	3.99	4.79	7.98	0.60	0.24
4%	10.00%	5.22	6.26	10.43	1.04	0.42
5%	12.50%	6.19	7.42	12.37	1.55	0.62
6%	15.00%	7.04	8.45	14.09	2.11	0.85

7%	17.50%	7.85	9.42	15.71	2.75	1.10
8%	20.00%	8.64	10.37	17.29	3.46	1.38
9%	22.50%	9.43	11.32	18.87	4.25	1.70
10%	25.00%	10.24	12.28	20.47	5.12	2.05

As after-tax operating margins increase, enterprise value multiples increase. The multiple that is most closely connected to the after-tax margin is EV/Sales and we examine the relationship between the two in Figure 9.5:

Figure 9.5: EV/Sales and After-tax Operating Margin



As with net margins, the lesson should be clear. When comparing enterprise value to sales ratios across companies, we should be cognizant of differences in marketing strategies and margins. If we are not careful about controlling for these differences, we will find companies with low after-tax operating margins looking cheap on an enterprise value to sales basis.

d. Tax Rates

The tax rate paid by a firm does affect its value, and through this value, all of the enterprise value multiples. The effect though is amplified on multiples of pre-tax

measures such as EBITDA and revenues. Using the hypothetical firm in illustration 9.2, we examine the effect of changing the tax rate (from the base case of 40%) on enterprise value multiples in table 9.8:

Table 9.8: Tax Rates and Enterprise Value Multiples

<i>Tax Rate</i>	<i>EV/EBITDA</i>	<i>EV/EBIT</i>	<i>EV/EBIT (1-t)</i>	<i>EV/Capital</i>	<i>EV/ Revenues</i>
0%	17.06	20.47	20.47	5.12	2.05
10%	14.15	16.98	18.87	4.25	1.70
20%	11.52	13.83	17.29	3.46	1.38
30%	9.16	10.99	15.71	2.75	1.10
40%	7.04	8.45	14.09	2.11	0.85
50%	5.16	6.19	12.37	1.55	0.62
60%	3.48	4.17	10.43	1.04	0.42

As the tax rate is increased, all enterprise value multiples decrease but the difference between the pre-tax multiples (EV/EBITDA, EV/EBIT) and the after-tax multiples (EV/EBIT(1-t)) increases as the tax rate increases. For example, if the tax rate is 10%, the EV/EBITDA multiple is 11.52 whereas the EV/EBIT(1-t) is 17.29. At a 40% tax rate, the EV/EBITDA drops to 7.04, less than half the EV/EBIT(1-t) of 14.09.

What are the consequences for relative valuation? When comparing companies with widely divergent tax rates, a failure to control for tax rate differences will result in high tax rate firms looking cheap on an EV/EBITDA basis, relative to firms with low tax rates. This is a scenario that many European analysts have faced when comparing companies in the same sector, operating in different countries. German companies should trade at lower multiples of EBITDA than Irish companies; the German tax rate is in excess of 38% whereas the Irish corporate tax rate is 12%. Even within the same market, companies may face different effective tax rates, largely as a consequence of net operating loss carry forwards (NOL) and tax planning. We would expect firms with large NOLs (and thus lower effective tax rates) to trade at higher multiples of EBITDA or EBIT.

Applications of Value Multiples

Now that we have identified the variables that affect each multiple and have a sense of how changes in these variables can affect enterprise value multiples, we can turn

our attention to using these multiples in relative valuation. In this section, we will begin, as we did the equity multiple application section, by looking at comparisons of companies within individual sectors and then look at market wide comparisons.

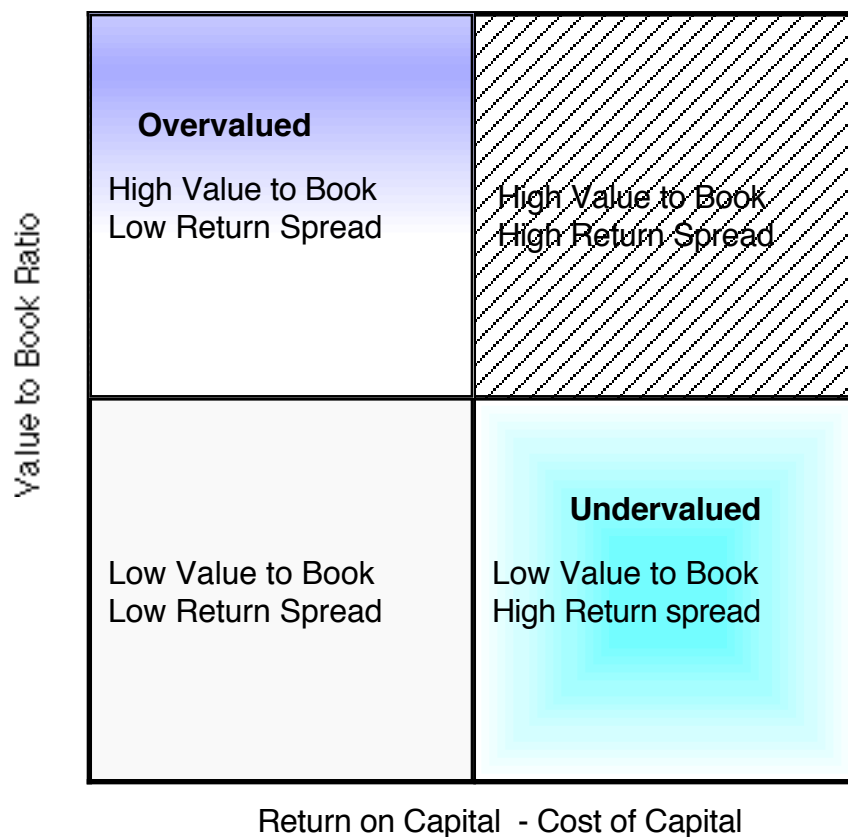
Sector Comparison

As with equity multiples, enterprise value multiples are used by analysts to compare firms within a sector. Even more so than with equity multiples, little is done to control for differences across firms in sample. Thus, while an analyst comparing PE ratios across software companies will at least consider differences in growth rates across the companies, analysts often just compare the enterprise value to EBITDA multiples across cable or telecom companies, with no consideration given to fundamental differences across the companies. In this section, we will look at four illustrations, where we will present three ways of controlling for differences across companies, paralleling the approaches used with equity multiples.

a. Subjective Judgments: This is the simplest extension of the naïve approach, where after comparing the values of enterprise value multiples across companies, we at least pause and consider the variables that we know affect those multiples to see if they explain the differences. Thus, we would examine the return on capital for a firm that trades at a low enterprise value to book capital ratio; if the return on capital is negative or very low, we would consider that to be a reasonable explanation for why the enterprise value to capital ratio is so low. The limitation of this approach is that only the most obviously misvalued securities will then come through this process as under or over valued. With most firms, after all, there will be at least one variable that potentially could explain why the multiple is higher or lower than the industry average.

b. Matrix Approach: In the matrix approach, we plot the multiple that we are analyzing against its companion variable. Applied to the enterprise value to invested capital ratio, for instance, we would plot the multiple against the after-tax return on invested capital as shown in Figure 9.6:

Figure 9.6: Valuation Matrix: Value to Book and Excess Returns



Firms with high and positive excess returns will tend to have high value to book ratios, whereas firms with negative excess returns will generally have lower value to book ratios. The firms that are misvalued will fall into one of the two highlighted quadrants. In the upper left hand corner will be the over valued firms with high enterprise value to capital ratios and negative or very low excess returns. In the bottom right hand corner will be the under valued firms that trade at low value to capital ratios while maintaining large, positive excess returns.

c. Regressions: The limitation of the matrix approach is that while highlighting outliers is easy, it is difficult to differentiate between firms that are not dramatically over or under valued. Furthermore, it is difficult to control for more than two variables in a graph since we cannot create more than three dimensions on a graph. Regressions are a much more powerful and versatile way of controlling for differences across companies. Not only can there be as many independent variables as the data will sustain, but we can allow for non-linear relationships between multiples and the fundamentals. The caveat, as with equity

multiples, is that our objective is not to explain away all differences across companies but only those differences that make sense fundamentally.

Illustration 9.3: Comparing EV/Operating income multiples

Enterprise value to EBITDA multiples are widely used to assess companies in manufacturing and heavy infrastructure businesses. Table 9.9 summarizes the enterprise value to EBITDA multiples for steel companies in the United States in March 2001.

Table 9.9: Enterprise Value to EBITDA: Steel Companies

<i>Company Name</i>	<i>EV/EBITD</i> <i>A</i>	<i>Tax Rate</i>	<i>ROC</i>	<i>Net Cp Ex/</i> <i>EBITDA</i>	<i>DA/EBITDA</i>
Ampco-Pittsburgh	2.74	26.21%	12.15%	15.72%	20.05%
Bayou Steel	5.21	0.00%	5.95%	12.90%	41.01%
Birmingham Steel	5.60	0.00%	6.89%	-28.64%	51.92%
Carpenter Technology	5.05	33.29%	9.16%	15.51%	28.87%
Castle (A.M.) & Co.	9.26	0.00%	8.92%	9.44%	27.22%
Cleveland-Cliffs	5.14	0.00%	7.65%	51.84%	26.33%
Commercial Metals	2.40	36.86%	16.60%	1.19%	26.44%
Harris Steel	4.26	37.18%	15.00%	3.23%	4.92%
Huntco Inc.	5.40	0.00%	4.82%	-48.84%	53.02%
IPSCO Inc.	5.06	23.87%	9.22%	50.57%	16.88%
Kentucky Elec Steel Inc	1.72	37.26%	6.75%	-25.51%	38.78%
National Steel	2.30	0.00%	8.46%	68.49%	53.84%
NN Inc	6.00	34.35%	15.73%	-15.04%	24.80%
Northwest Pipe Co	5.14	39.47%	9.05%	8.73%	17.22%
Nucor Corp.	3.88	35.00%	18.48%	15.66%	26.04%
Olympic Steel Inc.	4.46	37.93%	5.80%	-3.75%	26.62%
Oregon Steel Mills	5.32	0.00%	7.23%	-31.77%	49.57%
Quanex Corp.	2.90	34.39%	16.38%	-3.45%	29.50%
Ryerson Tull	7.73	0.00%	5.10%	3.50%	38.36%
Samuel Manu-Tech Inc.	3.13	31.88%	14.90%	-2.91%	21.27%
Schnitzer Steel Inds 'A'	4.60	8.70%	7.78%	-16.21%	38.74%
Slater STL Inc	4.48	26.00%	11.25%	0.80%	27.96%

Steel Dynamics	5.83	36.33%	10.09%	33.13%	23.14%
Steel Technologies	3.75	36.87%	9.22%	11.95%	27.69%
STEEL-GENERAL	4.14	38.37%	9.80%	21.69%	28.75%
Unvl Stainless & Alloy Prods	4.28	37.52%	14.51%	12.73%	15.15%
Worthington Inds.	4.80	37.50%	12.54%	0.16%	22.79%

The enterprise value to EBITDA multiples vary widely across these firms and many of these firms have negative net capital expenditures, partly reflecting the industry's maturity and partly the lumpy nature of reinvestments. Many of these firms also pay no taxes because they lose money. We regressed the EV/EBITDA multiple against the tax rate and depreciation as a percent of EBITDA.

$$\text{EV/EBITDA} = 8.65 - 7.20 \text{ Tax Rate} - 8.08 \text{ DA/EBITDA} \quad R^2 = 29.76\%$$

$$(6.37) \quad (2.36) \quad (3.60)$$

We did not use expected growth or cost of capital as independent variables because they are very similar across these firms. Using this regression, the predicted value to EBITDA multiple for Birmingham Steel would be:

$$\text{Predicted EV/EBITDA}_{\text{Birmingham Steel}} = 8.65 - 7.20 (0.00) - 8.08 (0.5192) = 4.45$$

At 5.60 times EBITDA, the firm is over valued.

Illustration 9.4: Comparing EV/Capital Ratios

Enterprise value to capital ratios are favored by many value consultants, whose focus is on getting companies to improve their project choices (and the resulting excess returns). In table 9.10, we estimate the enterprise value to capital ratios for European cosmetics firms.

Table 9.10: EV/Invested Capital Ratios: European Cosmetics Firms in January 2006

<i>Company Name</i>	<i>Enterprise Value</i>	<i>Invested Capital</i>	<i>EV/Capital</i>	<i>Return on Capital</i>
Ales Groupe	249.4841	105.86	2.36	10.47%
Beiersdorf Ag	8665.2	967	8.96	31.17%
Body Shop Intl	566.81	156.6	3.62	19.10%
Christian Dior	20194.7	9635	2.10	15.63%
Clarins	1919.484	506.63	3.79	16.54%
Inter Parfums	348.5415	96.79	3.60	15.55%
Jacques Bogart	85.14196	91.42	0.93	2.19%

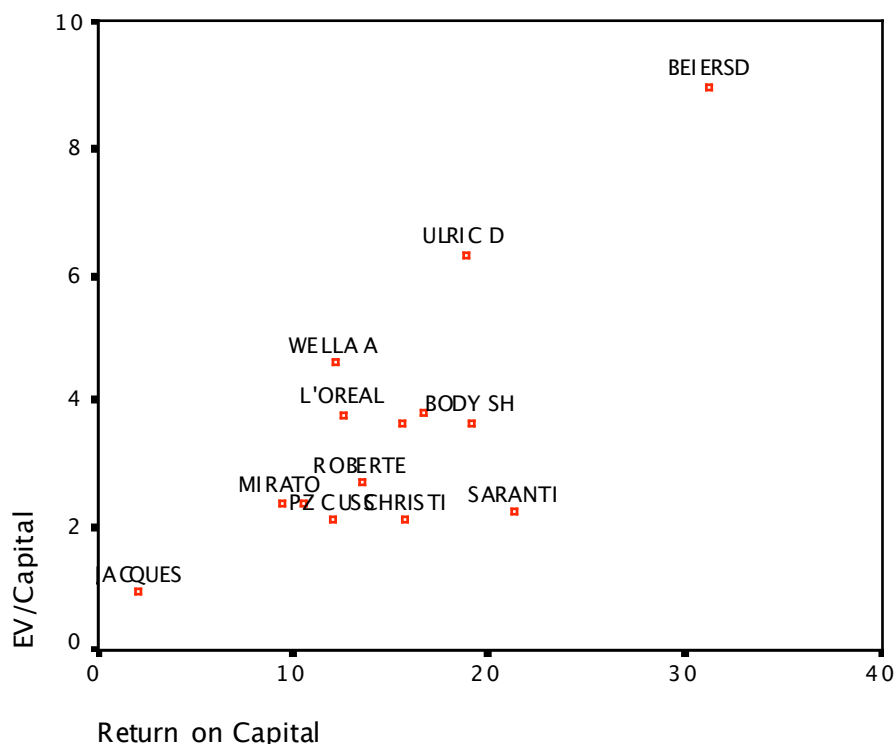
L'oreal	41313.47	11009.3	3.75	12.48%
Mirato Spa	154.428	65.24	2.37	9.40%
Pz Cussons Plc	569.3571	271.54	2.10	12.03%
Robertet Sa	282.1888	105.13	2.68	13.45%
Sarantis	366.6266	165.42	2.22	21.29%
Ulric De Varens	93.74	14.92	6.28	18.84%
Wella Ag	6501.858	1417.11	4.59	12.16%
Average			3.52	15.02%

In the last column, we report the after-tax return on capital earned by the firms in the sector.

Even a casual perusal of the table suggests a relationship between EV/Capital and the return on capital, with low returns on capital tied to low enterprise value to capital ratios. If we define an under valued firm as one that has a low enterprise value to book capital ratio while maintaining a high return on capital, a simple screening device would be to treat only companies that trade at EV/Capital ratios that are lower than the average for the sector (3.52), while maintaining returns on capital that exceed the industry average (15.02%), as under valued. Using that measure, only Sarantis and Christian Dior pass the test; the former trades at an enterprise value to sales ratio of 2.22 while maintaining a return on capital of 21.29%, while the latter trades at an enterprise value to sales ratio of 2.10 while earning a return on capital of 15.63%. By the same token, L'oreal and Wella look over valued, since they trade at EV/EBITDA multiples that are higher than the average while generating returns on capital that are lower than the sector average.

The link between EV/Capital and return on capital is confirmed in Figure 9.7, with a scatter plot of the former against the latter:

Figure 9.7: EV/Capital versus Return on Capital – European Cosmetics firms



Beiersdorf has the highest after-tax after-tax return on capital (31.17%) and the highest EV/Capital (8.96), ratio, whereas Jacques Bogart has the lowest enterprise value to sales ratio (0.93) and after-tax operating margin (2.19%). In this matrix, the under valued firms (like Sarantis) will fall towards the lower right hand quadrant, whereas the over valued firms will be in the upper left hand quadrant.

As a final test , we regress the enterprise value to capital ratio against the after-tax operating margin completes the analysis:

$$\text{EV/Capital} = -0.044 + 23.756 \text{ After-tax Operating Margin} \quad R^2 = 56.58\%$$

(0.05) (4.24)

In this sector, increasing the margin by 1% results in an increase in the EV/Capital ratio of 0.2376. Using this regression allows us to estimate the magnitude of the under and over valuation at individual firms. For instance, consider Sarantis and Christian Dior (the two firms that looked under valued with the simple test):

$$\text{Predicted EV/Capital}_{\text{Sarantis}} = -0.044 + 23.756 (0.2129) = 5.01$$

$$\text{Predicted EV/Capital}_{\text{Christin Dior}} = -0.044 + 23.756 (0.1563) = 3.67$$

Based on these predictions, Sarantis is undervalued by about 55% (with an EV/Capital ratio of 2.22) and Christian Dior by about 43% (with an EV/Capital ratio of 2.10).

Illustration 9.5: Comparing EV/Sales Multiples

Revenue multiples are used widely to analyze retail companies but they are versatile enough to work in any sector where there are significant differences in margins across companies. In table 9.11, we compare the EV/Revenue multiples of specialty chemical companies listed in different European markets:

Table 9.11: EV/Sales Multiples of European Specialty Chemical firms – January 2006

<i>Company Name</i>	<i>Enterprise Value</i>	<i>Revenues</i>	<i>EV/Sales</i>	<i>After-tax Operating Margin</i>
Auriga Inds-B	6023	5310	1.13	8.57%
Average			1.27	2.88%
Ciba Specialty-R	7732	7027	1.10	6.69%
Clariant Ag-Reg	5631	8144	0.69	2.74%
Degussa Ag	10976	11244	0.98	5.64%
Didier-Werke	260	444	0.59	4.79%
Dynaction	174	259	0.67	4.03%
Elementis Plc	411	389	1.05	0.10%
Graphit Kropfmue	63	73	0.87	1.59%
Gurit-Heber-B	705	579	1.22	2.74%
Lonza Group Ag-R	5104	2182	2.34	7.42%
Pcas-Produits Ch	154	194	0.79	5.60%
Rhodia Sa	4334	5281	0.82	-9.43%
Sgl Carbon	1140	926	1.23	7.04%
Siegfried Holdin	541	321	1.68	6.31%
Snia Spa	56	122	0.46	-33.83%
Umicore	3161	7115	0.44	2.98%
Victrex Plc	524	102	5.16	22.75%
Yule Catto & Co	573	537	1.07	1.99%
Zirax Plc	30	17	1.76	7.09%

Snia Spa, the firm with the lowest enterprise value to sales ratio, also has the most negative operating margin. At the other extreme, Victrex, with the highest enterprise value to sales ratio of 5.16, has the highest after-tax operating margin of 22.75%.

For a more complete examination of the relationship between EV to sales ratios and after-tax operating margins, we regressed the former against the latter for the firms in this sector:

$$\text{EV/Sales} = 1.10 + 5.71 (\text{After-tax operating margin}) \quad R^2 = 29.32\%$$

$$(5.22) \quad (2.91)$$

This regression can be used to estimate predicted enterprise value to sales ratios for any of the firms in the group. To illustrate, Yule Catto, with an after-tax operating margin of 1.99% will have a predicted EV/Sales ratio of 1.22:

$$\text{Predicted EV/Sales}_{\text{Yule Catto}} = 1.10 + 5.71 (.0199) = 1.22$$

At its actual EV/Sales ratio of 1.07, Yule Catto is undervalued by approximately 12.1%.

This analysis can be expanded to cover other variables that should affect enterprise value multiples. There are significant differences in financial leverage across these firms, which may make some of the firms riskier than others. To capture this effect, we estimated the interest coverage ratio for each firm and added the variable to the regression. Firms with higher interest coverage ratios should be safer than firms with lower interest coverage ratios and trade at higher multiples:

$$\text{EV/Sales} = 0.71 + 7.86 (\text{After-tax operating margin}) + 0.0108 \text{ Interest Coverage}$$

$$(2.91) \quad (1.61) \quad (2.62)$$

The R-squared of this regression is 84.68% and using it to estimate a predicted EV/Sales ratio for Yule Catto yields the following predicted value:

$$\text{Predicted EV/Sales}_{\text{Yule Catto}} = 1.10 + 7.86 (.0199) + 0.0108 (2.12) = 0.89$$

Yule Catto carries more debt than the typical firm in the sector and after adjusting for that higher financial leverage (with the interest coverage ratio), the firm is over valued by 20.5%.

Market Comparisons

Sector comparisons are useful in analyzing whether a company is under or over valued, relative to other companies in its sector, but they do not answer the broader question of whether a company is under or over valued relative to other companies in the market. Comparing companies in different businesses, with different risk, growth and cash flow profiles may seem like an exercise in futility, but it can not only be done but it

can provide insight, especially when entire sectors get misvalued. In this section, we will examine how value multiples vary across the market and the variables that seem to best explain the differences across companies.

a. EV/ Operating Income Multiples

The first set of market regressions that we present relate enterprise value to operating income and are computed using data on all publicly traded companies in the United States in January 2006. Beginning with the EV/EBIT multiple, we estimate the following regression, using the tax rate, reinvestment rate and expected growth rate in revenues (estimated by analysts) over the next 5 years (g) as independent variables:

$$\text{EV/EBIT} = 4.30 - 13.8 \text{ Tax Rate} - 0.23 \text{ Reinvest Rate} + 143.7 g \quad R^2=40.6\%$$

(4.40) (4.74) (3.20) (30.28)

Turning to EV/EBITDA multiples, we obtain the following output from the regression against the tax rate, reinvestment rate, return on capital and expected growth rate in revenues (g). The first three were computed from the filings from the most recent financial year and the last (expected growth rate in revenues) was a consensus estimate from analysts.

$$\text{EV/EBITDA} = 0.03 - 5.14 \text{ Tax Rate} + 1.20 \text{ ROC} - 1.70 \text{ Reinvest Rate} + 129.6 g$$

(0.04) (2.34) (0.78) (3.05) (34.32)

The R-squared of the regression is 50.9%.

While we do not want to make too much of differences in R-squared, the R-squared on the operating income regressions tend to be higher than those reported for the equity earnings regressions, in general, and the PE ratio regression, in particular. This would indicate that we can explain differences in operating income multiples with fundamentals a little better than we can explain those differences in equity multiples.

b. EV/ Capital Ratios

Is the link between value to book and return on capital stronger or weaker than the link between price to book and return on equity? To examine this question, we regressed the enterprise value to invested capital ratio against return on capital using data on all firms in the United States from January 2006.

$$\text{EV/Capital} = -1.35 + 12.6 \text{ ROC} + 27.0 g - 0.7 \text{ Reinv Rate} + .10 \text{ Debt/ Capital}$$

(8.89) (29.98) (24.62) (2.02)

The regression yields results similar to those obtained for price to book ratios and the R-squared is comparable at 57.3%. The return to capital remains the key variable explaining differences in the EV/Capital ratios across firms.

If the results from using value to book and price to book ratios parallel each other, why choose to use one multiple over the other? The case for using value to book ratios is stronger for firms that have high and/or shifting leverage. Firms can use leverage to increase their returns on equity, but in the process, they also increase the volatility in the measure – in good times, they report very high returns on equity and in bad times, very low or negative returns on equity. For such firms, the value to book ratio and the accompanying return on capital will yield more stable and reliable estimates of relative value. In addition, the value to book ratio can be computed even for firms that have negative book values of equity and is thus less likely to be biased.

c. EV/Sales Ratios

In the final regression, the cross-sectional data for firms in the United States in January 2006 is used to estimate the enterprise value to sales ratio, with after-tax operating margin, the expected growth rate in revenues (g) and reinvestment rate (RIR) used as independent variables:

$$VS = -1.24 + 8.55 (\text{Operating Margin}) + 24.1g + 0.76 \text{ RIR} \quad R^2 = 52.6\%$$

(10.3) (26.82) (24.58) (6.21)

The operating margin used was the margin from the most recent financial year, the expected growth rate in revenues over the next 5 years was a consensus estimate from analysts and the reinvestment rate was also computed using numbers from the most recent financial year. Every 1% difference in after-tax operating margins across companies results in a difference of 0.855 in the EV/Sales ratio.

Forward Revenues

With both sector and market comparisons, enterprise value multiples can be measured in terms of future revenues or operating income instead of current numbers. Thus, we could estimate the value as a multiple of revenues five years from now. There are advantages to doing this, at least for some firms.

1. For young firms that have little in revenues currently but are expected to grow rapidly over time, the revenues in the future – say five years from now - are likely to better reflect the firm's true potential than revenues today. Consider, for instance, the valuation of Sirius Radio in illustration 6.5 in chapter 6, where the revenues are projected to grow from \$187 million in the current year to \$4.535 billion in year 5. Using a multiple on the current revenues will be difficult to do but it may be easier to work with expected revenues five years into the future. Another category of firms where forward multiples are useful are distressed firms that are losing money currently. Since no earnings multiple can be applied to negative earnings, forecasting a future earnings number (which is positive) and applying a multiple to it will yield an estimate of value.
2. It is also easier to estimate multiples of revenues after growth rates have leveled off and the firm's risk profile is stable. This is more likely to be the case five years from now than it is today for both young and distressed firms.

Assuming that revenues five years from now are to be used to estimate value, what multiple should be used on these revenues? We have three choices. One is to use the average multiples of value (today) to revenues today of comparable firms to estimate a value five years from now and then discount that value back to the present. Thus, if the average enterprise value to sales ratio of more mature comparable firms in the radio/satellite business is 1.5, the value of Sirius in year 5 can be estimated as follows:

Revenues at Sirius in 5 years = \$4,535 million

Value of Sirius in 5 years = \$4,535*1.5 = \$ 6,802 million

This should be discounted back at the cost of capital of 11.44% to the present to yield a value for the firm today.

Value of firm today = \$6,802/1.1144⁵ = \$ 3,958 million

The second approach is to forecast the expected revenue, in five years, for each of the comparable firms, and to divide these revenues by the current firm value for each firm. This multiple of current value to future revenues can be used to estimate the value today. To illustrate, if current value is 0.8 times revenues in 5 years for comparable firms, the value of Sirius can be estimated.

Revenues at Sirius in 5 years = \$4,535 million

$$\begin{aligned}
 &= (\text{Revenues in 5 years}) \left(\frac{\text{Value today}}{\text{Revenues}_{\text{year 5}}} \right)_{\text{Comparable firms}} \\
 \text{Value today} &= (4,535)(0.8) \\
 &= \$ 3,628 \text{ million}
 \end{aligned}$$

In the third approach, we can adjust the multiple of future revenues for differences in operating margin, growth and risk between the firm being valued and comparable firms. For instance, Sirius five years from now, is projected (based upon our estimates) to have an expected operating margin of 6.23% and an expected growth rate in revenues of 14.35% over the following 5 years (years 6 through 10). A regression of value to sales ratio against operating margins and expected growth rates run across comparable firms today yields the following:

$$\text{Value to Sales} = 0.52 + 2.34 \text{ Operating Margin} + 6.16 \text{ Growth} \quad R^2 = 65\%$$

Plugging in the predicted values for expected growth and operating margins for Sirius into this regression.

$$\text{Value to Sales}_{\text{CommerceOne in 5 years}} = 0.52 + 2.34 * 0.0623 + 6.16 * 0.1478 = 1.57$$

The value of Sirius in five years can now be estimated using this multiple.

$$\text{Revenues at Sirius in 5 years} = \$4,535 \text{ million}$$

$$\text{Value of Sirius in 5 years} = \$4,535 * 1.57 = \$ 7,120 \text{ million}$$

$$\text{Value of Sirius today} = \$7,120 / 1.1144^5 = \$ 4,143 \text{ million}$$

While the use of forward multiples and future revenues or earnings is reasonable for young or distressed firms, there are some pitfalls that can be avoided if we follow a few simple precepts:

- Use expected values: The future revenues or earnings used in the valuation should be expected values and not best case estimates. With both distressed and young companies, we have to consider the probabilities that the firms will not make it to the future year and reduce the expected values accordingly.
- Don't double count growth: This approach is often used with high growth companies to obtain future values. However, analysts often use inflated multiples of earnings or revenues to obtain the future value and use the high growth potential of the company as a justification. Since the future revenue or earnings value already reflects a big chunk of the high growth, this leads to double counting of the growth.
- Convert into today's value: Applying a forward multiple to earnings yields a future value, which has to be discounted back to today to allow for comparisons to today's

market values. In the Sirius valuation, we used the 11.44% cost of capital, which reflects the high risk we face in getting to year 5, to discount back the future value.

Venture capitalists use a variant of this approach, where they estimate earnings in a future year for a young firm, and then apply an exit multiple (reflecting the expectation of a public offering or sale at that point) to estimate the future value. They then discount this value back at a high target rate of return (often 25-35%) to estimate the value today, and justify the high rate of return by pointing to the high likelihood of failure.

Conclusion

Enterprise value multiples look at market value of the operating assets of the firm and not just the equity invested in them. Thus, they provide a broader measure of value that are less affected by financial leverage decisions. In this chapter, the various measures of enterprise value were first introduced, with the emphasis on consistency. Cross holdings in other companies, whether classified as majority or minority holdings, can wreak havoc on the unsuspecting analyst when it comes to enterprise value multiples.

The determinants of enterprise value multiples come from looking at a simple discounted cash flow model for the firm. Not surprisingly, the same variables that determine firm value – cost of capital, growth rates and reinvestment rates – affect enterprise value multiples as well. Each multiple also has one variable that it is most closely linked to; with EV/Capital ratios, it is the return on capital, whereas with EV/Sales ratios, it is the after-tax operating margin.

In the final section, we looked at potential applications of enterprise value multiples in valuation and presented three ways of controlling for differences across companies – a subjective approach where we looked for qualitative reasons for deviations from sector averages, a matrix approach where we graph enterprise value multiples against the key variables determining these multiples and multiple regressions.
