15

Valuation from Comparables and Financial Ratios

A Practical Approach

NPV analysis is hard. Aren't there any easier alternatives? Surprisingly, the answer is yes. "Valuation by comparables," or "comps" for short, is the "practitioner's choice." This is not because comps are generally better, but because they are easier to calculate. On top of this advantage, their answers are *sometimes* better, too. And sometimes not. You need to understand what they can and cannot do for you.

15.1 Got Your Marbles?

Similar assets' market prices can give you value estimates.

The basic idea behind valuation by comparables is simple and best understood by analogy: Assume that you want to determine the value of five red marbles that you own. If black marbles cost $2 apiece, and if you are willing to assume that red marbles are valued like black marbles, then you can compute that the value of your five red marbles should be $10. It is not necessary to forecast what value marbles will have in the future or what discount factor applies: The market price of black marbles has already taken all this information into account.

Are the assets really similar?

Of course, the more similar black marbles are to red marbles, the better this method works. If they are not similar, you can go spectacularly wrong. If black marbles are made from coal and red marbles are made from rubies, then your value estimate can be orders of magnitude off.

Critical Assumptions

In sum, the method of comparables relies on three assumptions:

1. You can identify projects that are close comparables. In the example, it is "other marbles."
2. You can identify a measure that is value-relevant. Here it is "marble," not "red color" (in which case cherries or Ferraris could be better comparables than black marbles).
3. The market values similar projects similarly. This is the law of one price.

This only works if you are trying to find a best estimate of value in a reasonably-perfect market. If the market is not perfect, even if other identical red marbles sell for $2, you may not be able to sell your own red marbles for $2. However, as long as the market is perfect, it does not matter whether this market for red marbles is also fundamentally efficient or not. Even if you think that, based on future cash flows, marbles should have been worth $1 each, as long as the market is willing to pay the same $2 for your own red marbles as it pays for other marbles, your comparables-based valuation of $2 per marble is the correct value estimate. After all, you can sell your marbles for $2. Conversely, even if you believe that marbles will be worth $100 each in one year, you should realize that your own marbles are no different from others. Anyone can buy or sell as many of them at $2 as they wish. Your marbles are then really worth just $2 today, not $100 discounted. I admit that I am pushing the analogy: If the market were perfect, neither you nor anyone else would disagree with the market value, anyway.

15.2 Comparables and Net Present Value

An example application of comparables based on the P/E ratio.

Let's say you want to use the method of comparables to value Intel Corp, perhaps because you are Warren Buffett and you are considering buying all of Intel corp (fat chance).

First, you have to find another company that you deem to be similar. What is a good comparable? AMD (a competitive but much smaller fabless chip designer that Intel basically wiped off Intel's own map)? ARM (a mobile also fabless chip designer that basically wiped Intel off ARM's own map)? Microsoft (another tech and IP company whose fortunes are closely linked to Intel's)? HP (ticker HPQ), Intel's biggest customer? Apple, the world's most valuable company and also a hybrid hardware/software manufacturer with a quasi-monopoly on its specific products?

Second, you have to decide on a particular value-relevant attribute as your benchmark. Let's say you decide that this most relevant comparable is earnings. The valuation ratio is then the **price-earnings ratio** (**P/E** or **P/E Ratio**). In June 2016, with access to 2015 fiscal-year end numbers, YAHOO! FINANCE reported the following:

	Intel	Microsoft	AMD	ARM	AAPL	HPQ
Earnings Date	Dec	Jun	Dec	Dec	Sep	Oct
Trailing Earnings	$11B	$12B	–$0.6B	$0.5B	$53B	4.5
Forward (Analyst Consensus)	$13B	$22B	–$0.3B	$1.0B	$53B	5.0
Equity Market Value	$150B	$400B	$4B	$20B	$525	$20
Enterprise Value	$160B	$335B	$6B	$20B	$540	$22
Trailing P/E	14	40	NA	43	10	6
Forward P/E	12	18	NA	21	10	7

FYI, the enterprise value adds debt and subtracts cash to the equity market value.

Third, you must assume that the financial markets value firms like Intel and your comparable alike. Really? Each dollar of Intel's analysts' expected earnings translated into $14 of market cap. But if you believe that Intel was like Microsoft, then Intel was valued too low:

$$\text{Intel Market cap} \approx \underbrace{18}_{\text{Microsoft Frw P/E}} \cdot \underbrace{\$11 \text{ billion}}_{\text{Intel Frw Earnings (E)}} \approx \$200 \text{ billion}$$

But, because Intel is public, we happen to know that it should have been $150 billion. Or maybe Microsoft was priced too high? Or maybe Microsoft was not the right comp? Or maybe earnings were not the right metric? What should you do?

The Law of One Price

Ultimately, NPV and comparables-based valuation are both applications of the law of one price—first cousins.

Conceptually, the comparables method is really not that different from the "estimated NPV" method. Both methods seek to estimate a true net present value. Both methods want to do so by valuing your project *relative* to other projects. In an estimated NPV analysis, you compare your own project to a benchmark through the opportunity cost of capital (the discount rate). In a comparables-based analysis, you compare your own project to a benchmark through a metric—a valuation ratio, such as P/E—for one or a number of similar firms. Although both estimated NPV and comparables are based on relative valuation, comparables lean more heavily on identification of immediately similar projects and on the assumption that the market has valued these particular projects correctly. NPV is a bit more forgiving in its need to identify exact comparables. Its opportunity cost of capital uses a wider set of alternatives than just the select-est few couple of similar-looking firms in the same business. If any other firm has equivalent expected cash flows and equivalent costs of capital, then it qualifies as an NPV benchmark.

➤ Law of one price, Sect. 1.1, Pg.2.

Conceptually, either financial valuation method works the same way: through the law of one price.

IMPORTANT

It is the *law of one price* that ultimately gives you a value estimate.

- In theory, companies with the *same correct* attributes should have the *same* value.
- In practice, companies with *similar relevant* attributes should have *similar* values.

Let me expand upon the similarity in methods. To find the true net present value of a project, you must choose one or more attributes upon which to base your valuation.

Both methods work with "attributes" of firms. (NPV values an estimated statistic.)

- If you know the *true* NPV, you should use it for the comps analysis. It would be the metric on the X axis. Your graph with value on the Y axis would be a perfect diagonal line, and the NPV and Comps methods would be one and the same.
- Unfortunately, any attributes that you end up using on the X axis in the real world are inevitably less than perfect. For one, you cannot use the true NPV, simply because you rarely know it. All you can usually know is an imperfect NPV *estimate*. Nevertheless, if you have enough time to estimate NPV for many comps, this is a great approach. Analysts rarely do.
- One more readily-available attribute can be the earnings for similar firms from the same industry. (You would then work with price-earnings ratios.)

Earnings are the most common and most prominent comps attribute. (Mukhlynina and Nyborg report that 84% of firms use enterprise value divided by EBITDA.) However, there are also many possible other comp attributes (e.g., cash flows or sales). In real life, you could also use multiple attributes. But multidimensional graphs are tough to draw, so we shall discuss only single-attribute valuation techniques in this chapter. Let us call a valuation attribute simply an "attribute" or a "measure." If you draw your attribute on the x-axis and the true firm value on the y-axis, you would hope that the relationship is close and accurate.

For example, in graph (a) in Exhibit 15.1, the law of one price works very well. All firms line up nicely, like ducks in a row. This suggests that your measure is value-relevant, although it does not prove it. (It could merely be a lucky coincidence among other firms, and not applicable to your own firm—but let's assume it is not so spurious.) Now assume that you want to value a firm whose attribute (measure) is 60, which is indicated by a vertical line. You can easily identify similar firms, some with higher and some with lower measures. Your comps valuation is simple and accurate. And it even matters little whether your measure is estimated NPV, earnings, sales, or something else. It just works!

An example of a law-of-one-price valuation in which firms with similar attributes have similar values.

Graph (b) shows the situation in which you will usually find yourself. The values of all companies are surrounded by a good deal of uncertainty relative to your attribute measure. This is usually the case even if you use your NPV estimate. Although theory tells you that true NPV would make the perfect measure as in plot (a), the fact that you had to estimate NPV usually renders your graph more like plot (b).

Unfortunately, this is not how it usually is in reality. Usually, there is more noise.

Graphs (c) and (d) illustrate two more problems that are common in the context of valuation by comparables. In (c), the attribute is basically irrelevant for valuation. It tells you nothing about the value of your firm. In (d), even if you know the right value attribute, you have no comparables that have a similar measure as your firm. Your earnings may be 60, but all comparables from your industry have earnings of around 15 to 25. How should you extrapolate? The graph draws two possible lines, and they come up with rather different values for your firm. In this case, analysts sometimes expand the set of firms they look at, so that they also find some firms with higher P/E ratios. Unfortunately, P/E ratios may mean different things for firms drawn

Here are examples where the pricing method works poorly.

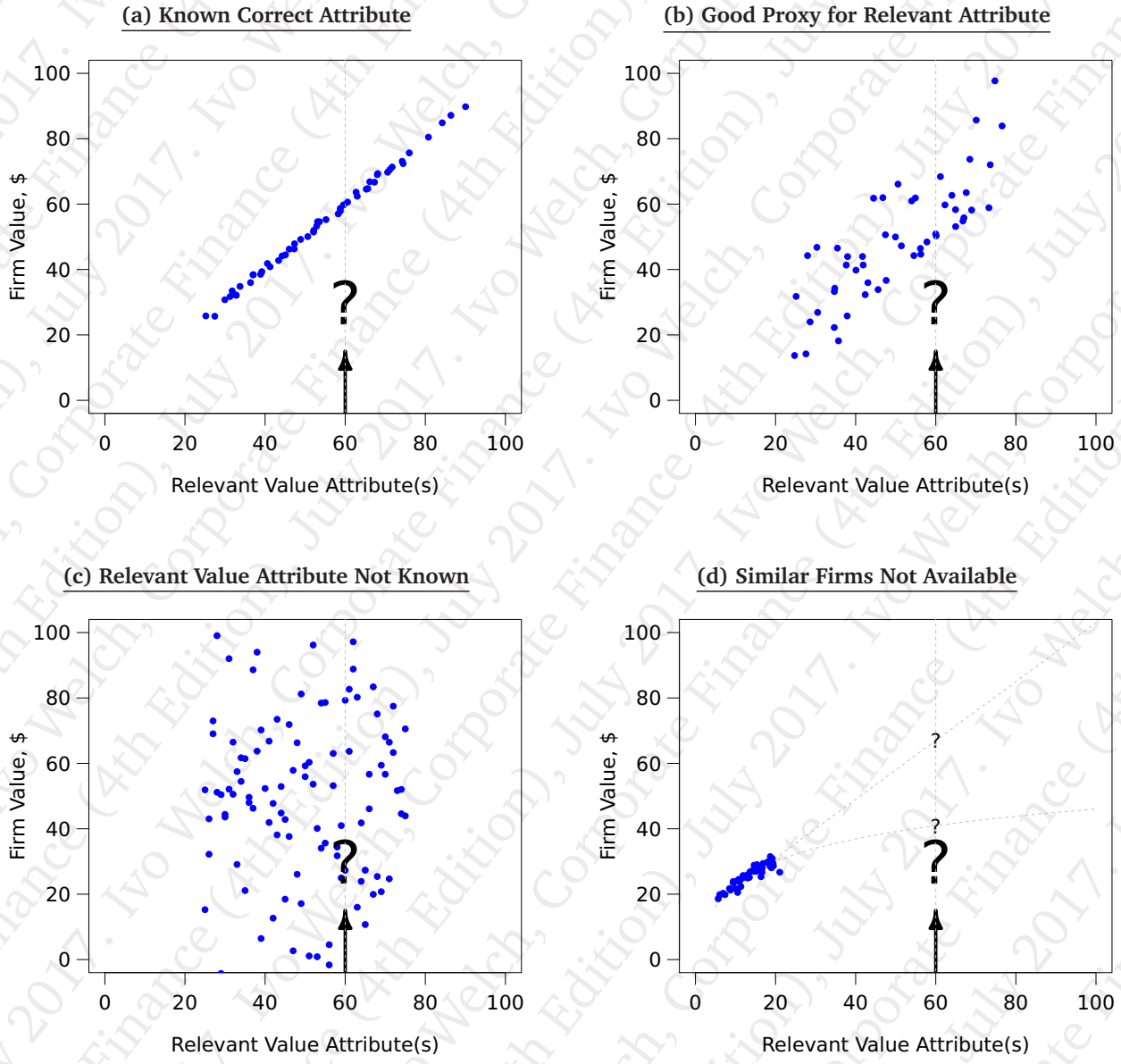

Exhibit 15.1: *Conceptual Issues with Attribute-Based Valuation by Comparables.* Your goal is to value a firm with some attribute of 60. You know the attributes and values of publicly traded comparable firms, plotted as big dots here. In graph (a), an attribute-based comparables valuation for your firm would seem to work almost perfectly. In graph (b), there is a lot of uncertainty, but attribute-based valuation would still seem useful. In graph (c), the attribute is not relevant for valuation, and thus valuation by comparables would fail badly. In (a)–(c), similar firms with higher and lower attributes are readily available. In graph (d), even though the value attribute may be known, there are no similar firms available. Thus, it would be difficult to extrapolate a value, and attribute-based valuation would fail again.

from different industries. So you might find yourself with a better value estimate, or you might end up with what you saw in (c) again—a measure that has very little or no relation to value.

In sum, the following are important for valuation:

The main conceptual requirements for using the law of one price.

1. You need to have a good value-relevant attribute (on the X axis). In particular, "your own estimated Project NPV" and/or "reported earnings" (which then works through the P/E ratio) are potentially good ones, but there can be many others.
2. You need to find other publicly traded companies that are similar to your own firm, so that you can believe that their price-to-attribute ratios should be similar. Preferably, you would have many such firms, some with measures higher, others with measures lower than your own firm. Your measure should be relevant and accurate so that the comparables' market valuations line up nicely.

The law of one price gives you an accurate valuation only if these conditions are met.

Is NPV or Comps Better?

Both estimated NPV and comparables are based on similar ideas. How do the two compare?

NPV has input estimation problems, but comparables are even more ad hoc in what the right input is. Comparables also often have a "no similar firms exist" problem.

Estimated NPV as a method has a lot of advantages. It has a beautiful theory ("true NPV") behind it. It identifies for you exactly what matters (the expected future cash flows) and how differently timed cash flows matter in different ways (through the discount rate). The theory even gives you the exact relationship between various estimated inputs and your final measures (the present value formula). To the extent that you can reach the ideals of the theory—finding good expected cash flow and discount rate estimates—you know that your valuation is accurate! (The theory even allows you to skip the time-consuming process of calibrating your measure to those of similar firms. If your inputs are accurate, then estimated NPV and true NPV have a one-to-one correspondence.) However, the estimated-NPV method also has two main disadvantages. First, your input estimates—especially your expected cash flow estimates—can be far off from the truth. Second, there is no objective standard for your estimates, and a third party cannot verify them. If you say the expected cash flows in 10 years will be \$1 million, and I say that they will be \$5 million, who is right?

Comparables as a method also has strengths and weaknesses. If there is a high correlation between the true NPV and your measure, then it can provide good value estimates. Its main disadvantage is that it is much more ad hoc: You have to make two important judgment calls. First, what is a good comparable firm? Second, what should you use as the appropriate valuation attribute? Again, earnings (through the P/E ratio) is a common measure, but it may not work well, and other attributes could fit better in your particular situation. Unlike estimated NPV, there is no one-to-one diagonal relationship between your measure and true NPV, so you must lean more heavily on many firms in your Exhibit 15.1-equivalent plot. Moreover, as with NPV, there are also numerous devils in the details, which you will soon learn more about. Yet one advantage of comparables is that the inputs can be more objective and more verifiable than those for NPV. Earnings and prices are known, so analysts can agree on precise numbers. Nevertheless, subjectivity comes back into play because analysts rarely agree on what firms are appropriate comparables and what attribute fits best. Such disagreement can create different subjective estimates, too, and thereby void the objectivity advantage.

In sum, you trade off judgmental uncertainty about future expected cash flows and appropriate discount rates (in an NPV estimate) against judgmental uncertainty about how good your measure is and how similar your comparable firms are. It is also often the case that whole firms are easier to value with comparables analysis, while individual projects are easier to value with present value analysis. And even more often, you have to work both.

Examples in which one method is better than the other.

To be specific, go back to our attempt to value Intel Corp. On the one hand, if your alternative is an investment in Treasury bonds, the method of comparables would make little sense. Treasury-bonds with their 1-3% yields in 2016 are so completely dissimilar that they are almost a non-sequitur here. You would always prefer an NPV-based estimate for Intel. On the other hand, if your alternative is an investment in a company like Microsoft, perhaps the comp value makes sense. It could approximate the true NPV better than any estimate of future expected cash flows *you* could come up with. If this is the case, then you could in effect freeride on the wonderfully accurate valuation analysis (incorporating all the true expected future cash flows and appropriate discount rates) performed for you by competitive financial markets with its millions of financial analysts.

Q 15.1. What is the law of one price?

Q 15.2. How do comparable projects enter the NPV formula?

15.3 The Price-Earnings (P/E) Ratio

For valuation, price ratios (multiples) are most convenient.

Let's look at comps a little more closely. The kind of ratios that you would be most interested in have a value in the numerator and an attribute in the denominator. The reason is that if you have a good price-ratio estimate, you merely need to multiply it by your project's or firm's attribute, and out comes an estimate of price:

$$\underbrace{\left(\frac{\text{Price}}{\text{Attribute}}\right)}_{\text{from Comparables}} \cdot \text{Attribute of Your Project} = \text{Price Estimate for Your Project}$$

Definition

The price-earnings ratio is price divided by earnings. Dividing a stock by a flow is a bit odd.

The price-earnings ratio (P/E ratio)—price divided by earnings—is the most popular comp measure.

$$\underbrace{\left(\frac{\text{Price}}{\text{Earnings}}\right)}_{\text{from Comparables}} \cdot \text{Earnings of Your Project} = \text{Price Estimate for Your Project}$$

The price is a stock quantity (a snapshot), whereas the earnings, usually annual net income, is a flow measure. This is an exception to the rule that one should not divide apples by oranges. Your hope is that annual earnings—though a flow number—can be a good proportional proxy for the stock value of the entire set of all future discounted earnings flows. If the one-year earnings are not representative of all future earnings, then the P/E ratio is most likely not such a good measure.

It makes no difference whether you work with per-share or overall firmwide earnings.

It does not matter if you compute P/E firmwide or on a per-share basis. A firm worth $100 million with earnings of $5 million has a P/E ratio of 20. If it has 50 million shares outstanding, its price per share is $2, its earnings per share is 10 cents, and its P/E ratio computed from these quantities is still 20. Its shares sell for 20 times earnings.

Earnings can be analysts' consensus forecast for next year, or current earnings. We keep the notation loose.

In the real world, price-earnings ratios are often, *but not always,* quoted as the current market price divided by the analysts' consensus estimate of *next* year's earnings. This is the **forward earnings estimate**, as opposed to the **trailing earnings estimate**. The forward estimate is an *expected* quantity, but known today. Forward earnings focus more on the future—and valuation should be forward-looking, not backward-looking—so they are often better.

Moreover, an informal variant of the growing perpetuity formula, $P = C/(r-g)$, helps intuition. Taking assumptions, liberties, and loosening notation, you can relate today's price to next period's earnings:

It's ok with the growth formula, too.

$$\text{Price} \approx \frac{\text{Expected Earnings}}{\text{Cost of Capital} - \text{Expected Growth Rate of Earnings}}$$

➤ Growing perpetuities, Formula 3.1, Pg.40.

(In any case, this matters little: The intuition would remain the same if you used the most recently reported earnings instead.)

Why use earnings and not cash flows in the ratio? Because accountants try to reflect more future in earnings.

After a whole chapter about why you cannot use earnings instead of cash flows for an NPV valuation, is it not a step back to revert to earnings? Actually, no. The reason is that earnings are often better representatives of future cash flows than current cash flows. Is this odd? No. It makes sense. Cash flows are usually "spikier" than earnings. When a firm makes a large capital expenditure or acquisition, it may have a large negative cash flow one year, followed by positive cash flows in the following years. This spikiness is not a problem in an NPV analysis, because the higher future cash flows will enter in the future terms. In contrast, earnings try to smooth inflows and outflows of large expenditures over many periods. It is a number that accountants have created for the very purpose you need here: a representative short-term stand-in for the long-term picture. For computing one representative ratio with just one single year's data, accounting earnings are more representative than cash flows. Nevertheless, annual earnings can still vary "too much" from period to period (relative to lifetime earnings); and managers can manipulate them more easily than they can manipulate cash flows.

Why P/E Ratios Differ

The main question: What drives differences in firms' P/E ratios?

One way to think of the P/E ratio is that it attaches an implicit overall value to each dollar of earnings. At a P/E ratio of 12, you might say that each extra dollar of earnings translates into an extra $12 worth of valuation—the shares sell for 12 times earnings.

But where do price-earnings ratios come from? Why do they differ across projects, firms, and industries?

One reason is that P/E ratios use current earnings as a proxy for all future earnings.

If you believe that your firm will not produce any future earnings, then your value estimate is just the this year's earnings. In contrast, if you believe that your firm will have future earnings (or even higher future earnings), then this year's earnings are just a shadow of your future earnings. Your value estimate per dollar of current earnings will be a number greater than one.

IMPORTANT

All else equal, the price-earnings ratio is higher for firms with more future earnings and more future earnings growth.

This is easiest to understand with an example using the perpetuity formula.

In the growing perpetuity formula from Chapter 3, the relation between a single year's earnings number and the stream of future earnings is captured by one parameter: the expected growth rate g. (PS: Firms with lower costs of capital r can also have higher P/E ratios, but this is rarely the main channel. Thus, we focus mostly on the earnings growth channel.) Let's think about this.

Differences in Expected Earnings Growth Rates

Assume firms are growing perpetuities. Let's determine a sensible price-earnings ratio for a hypothetical firm.

Assume that your firm is expected to earn cash and earnings of $100 next year and that its appropriate cost of capital is 15%. This firm is a perpetuity whose income will grow by 5% per year forever. Adopting the heuristic formula, the value is

$$\text{Value} = \$100/(15\% - 5\%) = \$1{,}000$$

$$\text{Value} = \text{Price} = \frac{\text{Expected Earnings}}{\text{Appropriate Interest Rate} - \text{Expected Growth Rate of Earnings}}$$

With a price of \$1,000 and expected earnings of \$100, the firm's price divided by expected earnings is its P/E ratio,

$$\frac{\text{Price}}{\text{Expected Earnings}} = \frac{\$1{,}000}{\$100} = \frac{1}{15\% - 5\%} = 10$$

$$\frac{\text{Price}}{\text{Expected Earnings}} = \frac{\left(\frac{\text{Expected Earnings}}{\text{Appropriate Interest Rate - Expected Growth Rate of Earnings}}\right)}{\text{Expected Earnings}} = \frac{1}{\text{Appropriate Interest Rate} - \text{Expected Growth Rate of Earnings}}$$

Faster-growing firms have higher price-earnings ratios.

What if this firm grew not by 5% but by 10% per year (forever)? Then its price/ earnings ratio would be

$$\frac{\text{Price}}{\text{Expected Earnings}} = \frac{1}{15\% - 10\%} = 20$$

The P/E ratio of this firm is higher because it has more future earnings growth.

Conversely, slower-growing firms have lower price-earnings ratios—except when they do not.

What if the market expected this firm to shrink by 5% each year? Such a firm would have a price-earnings ratio of only

$$\frac{\text{Price}}{\text{Expected Earnings}} = \frac{1}{15\% - (-5\%)} = 5$$

The P/E ratio of this firm is lower.

It's not always obvious what a dying industry is. For example, in my opinion, cigarette producers should suffer from negative annual growth rates and as a result have low price-earnings ratios. But in 2016, Altria (Philip Morris) had a P/E ratio of 20 and analysts expected earnings growth of 8% over the next 5 years. The high-tech biotech firm AMGEN had a similar expected earnings growth of 8%, but a P/E ratio of only 12. (Both firms had low debt.) There are also examples that match the theory. Tesla had a forward P/E ratio above 60. Uber had a (private) P/E ratio in excess of 150. These were mostly reflections of the market's expectations about their future earnings growth.

Near bankrupt firms can have high P/E ratios, too.

Note also that firms have two ways to increase their P/E ratios: increase price or decrease earnings. Firms that are close to bankruptcy but still have positive earnings often also have high P/E ratios. Their future earnings can be expected to grow relative to their distressed earnings.

Remember that the growth rate of earnings is not the expected rate of return to investors.

Do you find it confusing that earnings can grow by only 5% but investors expect to receive a 15% rate of return? Shouldn't an investor's expected rate of return be the growth rate of earnings? No—not at all. (Indeed, the expected rate of return [$\mathsf{E}(r)$] cannot be equal to the growth rate of earnings [$\mathsf{E}(g)$], or the NPV would be infinite.) The reason is that *the price today already capitalizes all future earnings*. For example, take a firm whose appropriate cost of capital is 10% and that will produce \$100 next year, \$50 the next year, and \$0 thereafter. There is no uncertainty. Clearly, the cash flows and earnings of the firm are shrinking dramatically. But the value of the firm today is $\$100/1.1 + \$50/1.1^2 \approx \$132.23$. Next year, the investor will receive \$100 and hold a remaining project of $\$50/1.1^1 \approx \$45.45$, for a total wealth of \$145.45. The (expected) rate of return, that is, the cost of capital, is $\$145.45/\$132.23 - 1 \approx +10\%$, even though the growth rate of earnings is –50%.

The Present Value of Growth Opportunities (PVGO)

Practitioners often work with PVGO (present value of growth opportunities).

Another common way to express the same information—to give perspective to the meaning of the growth component in P/E ratios—comes from decomposing the cash flows of a firm into two components: the ratio of a different hypothetical firm that has the same projected earnings as our company but has stopped growing, and the ratio of another hypothetical firm that has zero earnings right now but consists exclusively of growth opportunities. The latter component has its own name, the *present value of growth opportunities* (**PVGO**).

It comes from a hypothetical split of earnings into a "steady" part and a "growth" part.

You can split the market value of any company—regardless of its actual earnings—into these two components. You can label them the "steady" and "growth" components. For example, consider three eternal firms, all priced at \$150 and all with an appropriate cost of capital of 10%. The first (stable) firm has expected earnings of \$15, the second (growth) firm has expected earnings of \$12, and the third (shrinking) firm has expected earnings of \$20. What are their PVGOs? Decompose these firms' values into their two components:

1. The stable firm is worth

$$\$150 = \frac{\$15}{10\%} + \mathbf{X} = \$150 + \mathbf{X} \qquad (15.1)$$

$$\text{Price} = \frac{\text{Expected Earnings}}{\text{Cost of Capital}} + \text{PVGO}$$

To be an equality, x must stand for \$0. The market has priced this firm exactly as if it had no expectation of any future growth. Thus, 100% of this firm's value comes from the "steady component," and 0% from the "growth component." Eventually, in the very long run, you would expect mature and stable companies to settle into this mode.

2. The growing firm is also trading at \$150, but it earns only a constant \$12 next year. Its constant steady component would only be worth \$120:

$$\$150 = \frac{\$12}{10\%} + \mathbf{X} = \$120 + \mathbf{X}$$

$$\text{Price} = \frac{\text{Expected Earnings}}{\text{Cost of Capital}} + \text{PVGO}$$

With this firm's "steady component" worth \$120, its growth opportunities must be worth PVGO = \$30. Taking this further, you would say that \$30/\$150 = 20% of the firm's value is due to future growth opportunities, and 80% is due to its steady business.

3. The shrinking firm should have been worth \$20/10% = \$200 today if the market had expected it to earn its constant \$20 forever. To justify its actual market value of \$150,

$$\$150 = \frac{\$20}{10\%} + \mathbf{X} = \$200 + \mathbf{X}$$

$$\text{Price} = \frac{\text{Expected Earnings}}{\text{Cost of Capital}} + \text{PVGO}$$

Thus, the subtractive part is PVGO = –\$50, and its growth rate is –\$50/\$200 = –25%. This firm is not expected to maintain its business.

PVGO is aptly named: Firms that are stable have zero PVGO, those that are growing have positive PVGO, and those that are shrinking have negative PVGO. If you like algebra, you can rewrite the formula as PVGO/P = 1 – (E/P)/r, which expresses the fraction of value that sits in growth opportunities in terms of the firm's earnings yield and cost of capital. If you believe a firm's cost of capital is about 10% per annum, then firms with P/E ratios of 10 have zero PVGOs. Firms with P/E ratios of 20 have half of the values in the future.

Q 15.3. Why is it more common to compute a price-earnings ratio than a price/cash flow ratio?

Q 15.4. Which is likely to have a higher price-earnings ratio: Google or PepsiCo?

Q 15.5. A firm has earnings of \$230 *this year*, grows by about 6% each year, and has a price-earnings ratio of 40. What would its price-earnings ratio be if it could grow by 7% each year instead? How much would its value increase?

Q 15.6. Rearrange Formula 15.1 into its price-earnings form. What does this say about the earnings/price yield for firms with no PVGO? About firms with positive PVGO? Negative PVGO?

Q 15.7. If PVGO is positive, is $\mathsf{E}(g)$ positive or negative?

Q 15.8. Consider a stable firm with a market value of \$1,000 that produces cash of \$100 per year forever. The prevailing cost of capital for the firm is 10%.

1. Assume that the firm is financed with 100% equity. What is the P/E ratio?
2. Assume that if the firm refinances to a capital structure where \$500 is financed with debt and \$500 is financed with equity, then its debt has a cost of capital of 7.5% and the equity has a cost of capital of 12.5%. (The numbers I chose make sense in a perfect market. The so-called weighted cost of capital ($\$500/\$1{,}000 \cdot 7.5\% + \$500/\$1{,}000 \cdot 12.5\%$) is still exactly 10%. The firm's cost of capital has not changed.) What is the firm's equity P/E ratio now?
3. Has the increase in debt increased or decreased the firm's P/E ratio?

15.4 Problems with Price-Earnings Ratios

So what could possibly go wrong? Plenty!

The task was to value Intel based on Microsoft's P/E ratio.

Go back to the table on Page 388. Recall the attempt to value Intel with a Microsoft comp. It was "only" off by a factor of 50%.

$$\frac{\text{Price}_{\text{INTC}}}{\$13} = 18 \quad \Leftrightarrow \quad \text{Price}_{\text{INTC}} \approx 18 \cdot \$13 = \$234$$

$$\left(\frac{\text{Price}_{\text{INTC}}}{\text{Earnings}_{\text{MSFT}}}\right) = \left(\frac{\text{Price}}{\text{Earnings}}\right)_{\text{MSFT}} \quad \Leftrightarrow \quad \text{Price}_{\text{MSFT}} = \left(\frac{\text{Price}}{\text{Earnings}}\right)_{\text{MSFT}} \cdot \text{Earnings}_{\text{INTC}}$$

The degree to which the value estimate is off is simply the ratio of P/E ratios—here by a factor of 1.5. What about other comp firms instead? With AMD and its negative earnings, we could do nothing useful. With ARM, we would be off by even more than 50%. With Apple, perhaps the least similar peer, we were at least reasonably close to Intel's true market cap of \$150B. With HPQ, we would seriously undervalue Intel.

If comparables are dissimilar, either the market or the comparable is wrong. Usually, it is the latter.

What went wrong? There are basically two possible explanations. The first is that the law of one price has failed. The stock market valuations—of Intel, Microsoft, or both—were just plain wrong. This is unlikely. If the market values were systematically wrong and you knew how, you could presumably get rich quick. Buy undervalued firms, sell overvalued firms. (A nice platitude when/if it has worked ex-post.) The second is that your assumption that the two firms' values were basically alike in terms of their P/E ratios was incorrect. This is the more likely cause. There is a long litany of reasons why comparables are not really comparable. Let's go over them.

➤ Getting rich "easily", Sect. 12.5, Pg.294.

Selection of Comparison Firms

Intel and Microsoft

Although their fortunes are linked and both are tech firms, Intel mostly makes hardware and Microsoft mostly makes software. There are almost always some such differences between firms. Are there any two products, perhaps except for pure commodities, that are ever the same? Are there two companies that ever make exactly the same product mix, sell it in exactly the same markets, have exactly the same brand name, marketing, customer relations, etc.?

Finding good comparables: On what dimension should comparables be similar?

Normally, the single biggest problem with valuation by the method of comparables is finding good similar stocks. There are about 10,000 publicly traded firms to choose from. For a benchmark for Intel, hundreds still operate in IT. Are firms more similar if they are similar in assets, in their business products and services, in their geographical coverage, in their age, in their size and scale, in their management, governance, or sheer luck? Do they have to be similar in all respects? If so, chances are that not a single of the 10,000 firms will qualify. In fact, I can guarantee you that there is no company exactly like Intel. There is only one true Intel Corp.

Which alternative firm is the best comparable?

The companies above are as good a set of comps as it gets. But, among MSFT, AMD, ARM, AAPL, and HPQ, which one is the most similar? Depending on which firm you select, your Intel valuation could be $300, negative, $400, $100, or $90 billion. Which shall it be?

Different conclusions about the value of the same firm: Analyst errors and biases can create wide variations in valuations.

PS: A quick warning. Selecting comparables often depends not only on your judgment but also on your motives. If you really wanted to make a bid to buy all of Intel, you would argue for low comparables, such as HP or Apple, when you were negotiating. You would try to use them like a club (in Neolithic times). If you owned Intel, you would want to negotiate for a higher price, and you would argue fiercely that Microsoft and ARM make better comps. Of course, ultimately it is not valuation argumentations and vociferousness that will win the day and determine the price, but the preferences of and alternatives to buyers and sellers.

(Non-)Aggregation of Comparables

Betas and costs of capital combine nicely—you can take value-weighted averages. A merged company is worth the same as the sum of its parts. Is this true for P/E ratios? No!

NPV analysis has a beautiful property to it. If your NPV analysis tells you that firm FMA is worth $1,000 and firm FMB is worth $5,000; and if FMA and FMB then merge and there are no synergies, would your NPV analysis of the merged FMAB firm be higher or lower? Neither. It would predict a $6,000 value, of course. This is because cost-of-capital averages can be value-weighted, and present values can be added.

Does comp-based valuation have the same aggregation property? Unfortunately not. Is this just an academic egghead problem? No. When an analysis can suggest that a merged FMAB firm's price-earnings ratio has value appear out of or vanish into nothing, you have a problem. A big one. The lack-of-averaging property has many strange implications.

For example, think about what would happen to Intel's valuation if Microsoft and Apple merged. Before, your peers had one P/E ratio of 18 and one of 10, for an average of 14. After they merge, you would have a P/E ratio of 12.3, based on a market cap of $925 billion on earnings of $75 billion. All your calculations would now be different. But Intel's, Microsoft's, and Apple's values should not have changed in the absence of externalities.

IMPORTANT

- Unlike market betas and costs of capital, price-earnings ratios cannot be value-weighted and averaged.
- Mergers can change P/E ratios even if they do not create value.

So, you cannot average P/E ratios. However, in real life, analysts average anyway—not because it is a good way to do it, but because most do not even realize what they are doing. You may decide that you want to average, too, but at least you should understand what you are getting yourself into.

You would want to average somehow. (Unfortunately, it has no underlying valid basis.)

How would Intel's true value change if Microsoft split off its XBox division? Probably not much in real life; but based on P/E ratios, it could suggest a different value now. Another strange aspect is about valuation of conglomerates. Should you use "average" P/E ratios from multiple comparable firms, one for each subsidiary, or try to find a conglomerate peer?

The consequences of the aggregation failure mean, strictly speaking, that only the most basic single-product firms should be compared.

Naturally, even though I have just explained that you cannot aggregate and disaggregate P/E ratios, you will still be tempted not to adopt the P/E ratio of any one single peer but those of a few firms. And like anybody else, you will be tempted to "split the difference." Yes, you can only compare full firms that are similar in all respects, and P/E ratios are likely to work well only for simple and well-defined companies, and not so well for conglomerates with many subsidiaries. But what else can you do? You are stuck between a rock and a hard place.

The 1/X Domain Problem

There is an even worse problem.

IMPORTANT

Ratios intrinsically never make sense when denominators can take on negative values.

A P/E ratio in which E is small or negative is bad, bad, super-bad!

This is the case for the P/E ratio, because earnings can be (temporarily) zero or negative. This can totally mess up any P/E ratio analysis. The function 1/Earnings is both discontinuous and very steep when earnings are close to zero. For instance, if a firm with a price of $10 has projected earnings of 1 cent, it has a P/E ratio of 1,000; if its earnings fall by just one more cent, it has a P/E ratio that is undefined; if its earnings fall by yet another cent, its P/E ratio suddenly becomes –1,000. Call this the "1/X domain problem."

Ignoring negatives in averages?

So let's assume you decide to average P/E ratios for Intel. Easy. Recall the forward ratios

MSFT	AMD	ARM	AAPL	HPQ
18	NA	21	10	6

What is the the right way to treat AMD's –8 P/E ratio? NA (ignoring it)? After all, stocks with limited liability cannot have negative market caps. If you ignore it, your average is about 14. Not a bad approximation, knowing the true P/E ratio of 12. But is this correct?

What do minor changes in forward earnings do?

If you answered yes, ask yourself what your industry average would have been if analysts reported a minor correction—they did not expect AMD to lose $300 million, but to gain $150 (not million). Then, AMD's P/E ratio would have been included as 40, and your industry average would have been 10 and not 16. "Ahhh" you say, but you would have noticed this and taken appropriate action (exactly what??). Then what about $1 million? Or –$150? Whatever you do with the single (and small) AMD firm will have a dramatic effect on your average industry valuation P/E, and thus in turn on your value estimate for Intel.

Remedies for the 1/X Domain Problem

Here is a set of ad hoc methods to improve the averaging of P/E ratios. None are perfect. All are ad hoc.

Unfortunately, there is no entirely satisfactory method to remedy the 1/X domain problem. There are only some ad-hoc procedures that try to deal with it.

1. **Ignore nonpositive earnings firms:** As noted, the most common industry practice is to drop out firms with nonpositive earnings from P/E averages. Unfortunately, this is not necessarily a good solution. First, you want an accurate valuation, and the stock market did value AMD at $4 billion. You have no good economic reason to ignore it, just because earnings were negative. The dropping in and out of your averages when the firm is just below vs. above 0 means that a small change in the earnings of just one comparable can have a huge impact on your comparables valuation due to arbitrary inclusion/exclusion of comparables.
2. **Use the median, not the mean:** The *mean* P/E ratio is often drastically changed by one negative-earnings outlier firm. In contrast, the *median* firm's P/E ratio is often not affected by the negative-earnings firms. In this case, the median P/E of "18, *weirdo*, 21, and 10" is not affected by *weirdo*. The drawback is that the median ignores many specific P/E quantities—information that should be quite relevant.
3. **Average E/P yields and invert:** The reciprocal of the P/E ratio is the **earnings-price yield**:

$$\text{Earnings Yield} = \frac{\text{Earnings}}{\text{Price}} = \frac{1}{\text{P/E Ratio}}$$

   It is guaranteed to have a positive denominator. Therefore, it avoids the 1/X domain problem. Therefore, it is always meaningful even if earnings are negative. It takes care of cases in which a small positive earnings can have insidiously large but unnoticed influences, too. If the earnings are positive, then a higher price-earnings ratio implies a lower earnings/price yield, and vice-versa. In our case,

	Microsoft	AMD	ARM	AAPL	HPQ
Forward Earnings Yield	5.5%	–15%	2.5%	10%	16%

   The average earnings yield here is 3.8%, which inverts to a P/E ratio of 26.
4. **Work with sums:** Instead of averaging individual firms' P/E ratios, you could first add up all Ps and all Es before you divide them. Adding the consensus earnings estimates of the peers comes to about $80 billion. The market cap total is about $970, for a P/E "average" of about 12. Note how AMD effectively no longer matters—even with its negative earnings. This procedure in effect value-weights stocks. If the company to be valued is very large (like Intel), this can make sense. If the company to be valued is small, do you really want to base its value estimate primarily on large peers?

These methods can *sometimes* provide reasonable estimates if only a very few firms in the industry have mildly negative earnings. If this is not the case, it is better not to use the P/E ratio in the first place. Earnings then is probably not a meaningful number to even start considering.

IMPORTANT

- Formally, neither P/E ratios nor E/P yields can be averaged across projects or firms.
- In real life, some sort of informal averaging is often called for. This is because it is often worse to rely on just one single comparable.
- Simple P/E averaging can lead to nonsensible estimates. There are reasonable, though ad-hoc, ways to improve on it: using the median, dropping firms with low earnings, averaging E/P yields, or dividing only aggregate price by aggregate earnings.

Never take P/E ratio averages literally. Your goal is only to find an "intuitively good average P/E ratio equivalent" for your type of firm, derived from multiple comparables, not an exact number.

Which P/E Ratio to Believe?

Exchange-traded funds (ETFs) are baskets of securities, often put together to mimic an index. You can think of ETFs as firms for which you know the value—and price-earnings ratio—of each and every division (stock component).

On March 13, 2006, the *Wall Street Journal* reported that Barclays Global Investors (now Blackrock) calculated the P/E ratio of its iShares S&P 500 ETF as 16.4 and that of its iShares Russell 2000 ETF as 19.1. The Russell 2000 includes many midmarket firms. It garnered nearly $7.5 billion from investors and was one of the fastest-growing funds in 2006. Do these two funds look comparable in terms of their valuation ratios?

If you had computed the weighted sum of the market value of all stocks in the Russell 2000 index and divided that figure by the companies' total earnings, you would have found that this ETF had a P/E ratio of 41, not 19.1. Why the difference? It is because BGI excludes all loss-making companies in its iShares ETF when computing its P/E ratio—thus there were many Russell 2000 components excluded. Karl Cheng, an iShares portfolio manager, said that investors don't normally look at negative P/E ratios for companies, so they don't include them in their average. He suggested that investors should consider other measures. Thanks, Karl!

The Wall Street Journal, *March 13, 2006 (page C3).*

Q 15.9. Is the P/E ratio of a merged company with two divisions, A and B, the value-weighted or equal-weighted average of the P/E ratios of these divisions?

Q 15.10. A firm with a P/E ratio of 20 wants to take over a firm half its size with a P/E ratio of 50. What is the P/E ratio of the merged firm?

Q 15.11. Why can it be most hazardous to work with P/E ratio averages? What would you call this problem (and where does it come from)?

Q 15.12. What can you do if only one among a dozen industry comparables has a negative P/E ratio?

Trailing 12-Month (TTM) Adjustments

When comparable firms report annual statements in different months, the intrayear change in economic climate can introduce another problem.

There is another smaller mechanical problem: timing. First, is it meaningful to use annual earnings from a comp if the annual reports differ by 6 months? Or should you use just the most recent quarter's numbers? Only about half of all publicly traded firms report earnings for calendar years (with information released after the accounting department finishes and releases the report sometime around March to June). You may not want to compare financials that are timed too differently, especially if the economy has changed in the second half of the year. In our example, Microsoft reported earnings of

	Fiscal	Calendar	Sales	Net Income	Sales	Net Income
	FQ1, 2015	**14/09/30**	23.2	4.5		
	FQ2, 2015	**14/12/31**	26.2	5.9		
	FQ3, 2015	**15/03/31**	21.7	5.0		
	FQ4, 2015	**15/06/30**	22.2	–3.2	93.6	12.2
	FQ1, 2016	**15/09/30**	20.4	4.6		
Intel's Date→	FQ2, 2016	**15/12/31**	23.8	5.0		
	FQ3, 2016	**16/03/31**	20.5	4.1		
	FQ4, 2016	**16/06/30**	...	...		

Like many other firms, Microsoft's fourth-quarter sales are higher than its other quarter sales. (Here, it was due to the Christmas 2015 introduction of *Xbox One* game consoles.)

To adjust Microsoft's earnings "as if they had closed their fiscal year at the same time," don't use quarterly earnings. Instead, shift the entire fiscal year yourself. Start with Microsoft's $12.2 billion earnings; add the FQ1 2016 (Sep 2015) of $4.6 and subtract the FQ1 2015 (Sep 2014) of $4.5; add the FQ2 2016 (Dec 2015) of $5.0 and subtract the FQ2 2015 (Sep 2014) of $5.9. These are called **trailing twelve month** (**TTM**) figures.

Fortunately, this time difference can be relatively easily taken care of via "trailing 12-month" (TTM) figures.

$$\text{As if Annual} = \$12.2 + (\$4.6 - \$4.5) + (\$5.0 - \$5.9) = \$11.4$$

$$\text{TTM Earnings} = \text{FY15} + (\text{FQ1-16} - \text{FQ1-15}) + (\text{FQ2-16} - \text{FQ2-15})$$

Watch out, though:

TTM only works for "flow" numbers (such as income), not for stock numbers (such as assets).

- TTM adjusts only "flow" numbers (such as earnings or sales), never "stock" numbers (such as corporate assets or liabilities). Stock numbers are whatever was reported as of that point in time.
- Managers have tricks to hide skeletons. Firms can switch fiscal year ends to make consecutive-year comparisons more difficult. A year can contain 52 weeks one year and 53 weeks the next. When a firm switches from a calendar year to a 52-week year, it gains an extra few days and thus extra sales and earnings. Firms can switch from November fiscal years to December fiscal years and thereby report 13 months instead of 12 months and sometimes the opposite in order to "save" up reserves to do the opposite switch again in a future year. (There are also other non-date-related accounting games. For example, when one firm buys another firm it can restate the financials and they become some mix—again, making it more difficult to benchmark accounting performance. Yet another complication is that new CEOs like to write down all sorts of earlier bad investments, so that their "own" future performance will look better. In 2015, the new CEO Satya Nadella wrote down the Nokia acquisition of his predecessor, Steve Ballmer.)

Take *extra* care.

Q 15.13. Go to YAHOO! FINANCE and rework the calculations to create comparable P/E ratios for the most recent trailing quarter for Intel, Microsoft, AMD, ARM, AAPL, and HPQ.

Debt Adjustments for P/E Ratios

As you already know, companies can be financed through a mix of debt and equity. Does the P/E ratio of a firm depend on this mix? If a firm with more debt in its capital structure has a different P/E ratio, then you cannot compare two otherwise identical companies, *because* they have different debt ratios. Put differently, could your "just-perfect" comparable firm that does everything just like your own firm evaporate when it has a different capital structure?

Does leverage influence P/E ratios?

It turns out that debt indeed changes the P/E ratio, but not necessarily either positively or negatively. Roughly speaking:

Unfortunately, the answer is yes.

- For growth companies (with a high earnings growth rate), more debt tends to increase the P/E ratio.
- For value companies (with a zero or negative earnings growth rate), more debt tends to decrease the P/E ratio.

You will get to see this for yourself in the problems at the end of the chapter.

Here are some sample inputs from YAHOO! FINANCE. We illustrate adjusting P/E ratios for different leverage ratios.

It is possible to make firms more comparable again. (If you don't, maybe you should not compare them. You would not want to compare the equity of one highly levered firm to another firm that is completely unlevered.) One sensible method to reduce the influence of capital structure is to move from an equity-based to a firm-based unlevered P/E ratio, both for the firm to be valued and for its benchmarks.

1. All debt would become equity. It also makes sense to ignore all the cash of the firm, because it could go straight to pay off debt. Thus instead of the market cap of equity (P) in the numerator, you would use the aforementioned enterprise value.
2. All interest payments would become just like equity payments and be added to earnings (E).

In a perfect market, this information is enough to compute the unlevered P/E ratio. In an imperfect market, a change in leverage could also change the total amount of cash flows. For example, if a firm could save on corporate income taxes by having more debt, the total amount of payments to debt and equity could increase.

Fortunately, in the case of our specific tech firms in 2016, none had large net interest expenses, and their enterprise values were about the same as their equity market caps. Empirically, debt adjustments rarely change price-earnings value inferences dramatically, except in cases of extremely highly-levered firms like banks or badly mismatched peers.

Q 15.14. A firm has a P/E ratio of 12 and a debt-equity ratio of 2:1 (66.7%). What would its unlevered P/E ratio (i.e., the P/E ratio of its underlying business) approximately be?

Q 15.15. In October 2002, the seven auto manufacturers publicly traded in the United States had the following figures:

Manufacturer	Mkt.Cap	Earnings	Manufacturer	Mkt.Cap	Earnings
Volvo (ADR)	$5.7	–$0.18	DaimlerChrysler	$32.3	$4.63
Ford	$14.1	–$5.30	Honda (ADR)	$37.7	$3.09
GM	$18.8	$1.83	Toyota (ADR)	$87.3	$4.51
Nissan (ADR)	$27.0	$2.55			

(All quoted dollars are in billions. Ignore debt. ADR means American Depositary Receipt, a method by which foreign companies can list on the New York Stock Exchange.) On the same day, Yahoo! Germany reported that Volkswagen AG had earnings of 3.8 billion euros. In terms of sales, Volkswagen was most similar to Volvo and Ford. What would you have expected Volkswagen to be worth? What assumptions are you making?

15.5 The Empirical Evidence in 2016

Now let us look at the empirical data to assess how well earnings-based valuation by comparables works in practice. We will look at snapshots taken in 2016.

Statistics for Some Selected Firms

Exhibit 15.2 presents the price-earnings ratios for the Dow Jones 30 components in June 2016. You can readily download data to create similar tables from YAHOO! FINANCE. Stare at them. I find it humbling to look at them. I can spin stories ex-post why one is high and another is low, but if I had had to do this ex-ante, it would have been a stab in the dark. Why is Chevron high-growth and Intel is not? Beats me.

Here is a sample of firms to illustrate the usefulness of PVGO.

AAPL	Apple	10	HD	Home Depot	22	NKE	NIKE	24
AXP	American Express	12	IBM	IBM	11	PFE	Pfizer	28
BA	Boeing	17	INTC	Intel	13	PG	Procter & Gamble	26
CAT	Caterpillar	38	JNJ	Johnson & Johnson	21	TRV	Travelers	11
CSCO	Cisco	14	JPM	JPMorgan Chase	10	UNH	UnitedHealth	22
CVX	Chevron	146	KO	Coca-Cola	27	UTX	United Tech	12
DD	du Pont	26	MCD	McDonald's	23	V	Visa	26
DIS	Walt Disney	18	MMM	3M	22	VZ	Verizon	12
GE	General Electric	40	MRK	Merck	34	WMT	Wal-Mart	16
GS	Goldman Sachs	16	MSFT	Microsoft	38	XOM	Exxon Mobil	29

Exhibit 15.2: *Dow-Jones 30 Trailing P/E Ratios in June 2016.* Ratios are starkly rounded to reduce the illusion of accuracy.

On the other hand, comps are not always this dire. For example, for the major auto manufacturers, I found

Ford	GM	Honda	Toyota	Daimler	BMW
6	5	6	6	6	7

Victory! These comps look great—at least until you look at Tesla, which has a P/E ratio of 60.

Earnings, Prices, and Price-Earnings Ratios

Individual stocks are interesting and fun—but it is more informative to look at data more systematically. So, how useful was earnings-attribute-based valuation of publicly traded firms in 2016?

Figure 15.3 plots firms' 5-year earnings growth against their forward earnings yields (E/P). Firms with higher earnings growth should have higher P/E ratios and thus lower E/P ratios, at least for positive-earnings firms. (One could limit the comparison to industries, which would improve the plot a little—especially for auto manufacturers—but not by much, just as would any adjustments for the slew of issues we discussed earlier.

The conceptual figures in real life.

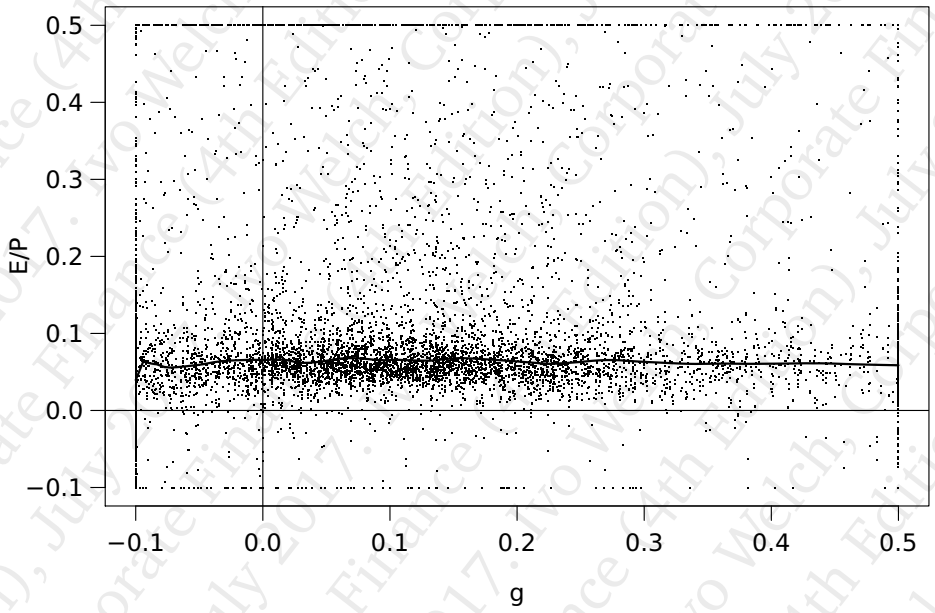

Exhibit 15.3: *5-Year Growth Rate of Earnings versus Forward Earnings Yield, 2016.* Each dot is a stock. Ratios were winsorized at –10% and +50% (this means outliers were truncated at these values). The fitting spline is smoothed but not forced to be linear. The data source is IBES. Theory says you should see firms with similar g have similar E/P ratios, and firms with higher g have higher E/P ratios.

Frankly, I cannot see clear patterns in Exhibit 15.3. Moreover, the variations in E/P ratios for the same growth rates are so tremendous that they swamp any mean patterns. Look at any x-slice for a normal growth rate of earnings. Now consider the y-axis. A 5% earnings yield means "only" twice the P/E ratio of a 10% earnings yield. What is a price disagreement of "double" *among friends*? (Joke!) But there are even firms with similar earnings growth rates (a vertical slice), where one has a P/E ratio of 100 and the other a P/E ratio of 2. What is a price disagreement of "factor 100" among friends?

(Sarcasm warning)

Managers and analysts often do not realize how noisy their estimates are, simply because they generally use around 5-10 *carefully* chosen comparables, where "carefully" could be replaced with the word "conveniently." Ignorance can be bliss, especially if it is not one's own money at stake.

Conclusion: It's useful information, but definitely not definitive. You cannot trust valuation by earnings comparables.

Exhibit 15.3 should suggest clearly to you that earnings-based attribute valuation (or equivalently, price-earnings-based attribute valuation) is not a very accurate valuation method. In terms of Exhibit 15.1, the empirical reality in 2016 was most similar to the "completely useless" plot (c), with tinges of "modestly useful" (b). If you had hoped that attribute-based valuation was the panacea that would rescue you from difficult and error-prone NPV calculations, you should be greatly disappointed.

Pair trading is really the same thing.

Incidentally, some funds have tried to exploit the differences in Exhibit 15.3 for **pair trading**, where they go long one stock with a low P/E ratio and short another "similar" stock in the same industry with a high P/E ratio. Such strategies have sometimes been successful, but not spectacularly so. They fail because there is no strong force that tends to push firms with similar

earnings growth towards similar P/E ratios. They don't tend to revert a lot to similar values.

Valuation merely by comparables is bound to be very error-prone. Most analysts have concluded that they need to try many different methods to form an opinion. Who said valuation was easy? Who said theory was harder than real life? It ain't so.

C'est La Vis.

Time-Changes in the Price-Earnings Relation

One warning: you cannot use any specific year's figure (e.g., the 2016 plot in Exhibit 15.3) to assess how this graph will look in another year. One reason is that during economic booms, earnings growth is high, and although P/E ratios are high, too, they are not high enough for the eternal smooth-growth formula. Boom earnings growth is unsustainable. Eventually, the boom must end. In contrast, during recessions, earnings growth can be negative. Yet P/E ratios remain relatively too high, because investors expect that earnings will eventually grow again. For example, in December 2000 corporate earnings grew at an average rate of +40%, which was clearly unsustainable. If you had relied on the growing perpetuity formulas, firms would have seemed to be undervalued. By December 2001, that is, post 9/11, the opposite had happened: The median earnings had fallen at a year-to-year rate of –40%. Investors would not have expected this malaise to last forever. If you had relied on the growing perpetuity formulas, firms would have appeared to be overvalued.

Unfortunately, the relation between earnings growth and price-earnings ratios (and thus the figure) changes over the business cycle, so you must use an up-to-date version for today's valuation.

So remember: the cross-sectional relation between earnings growth and earnings/price yields, both based on forward earnings estimates, is not stable over the business cycle. Therefore, to value firms, you must first plot the *prevailing* relation between earnings growth and earnings yields (the inverse of P/E ratios) at the time. Do not use Exhibit 15.3—it only applied to the situation in early 2016.

Interpreting (Historical) P/E Ratios for the S&P 500

Finally, let's see how the P/E ratio model works in the overall stock market. Time-series changes "should" be a lot easier to understand than cross-sectional variations in stock values. We shall use the (effectively value-weighted) S&P 500 as a stand-in for the stock market. The upper plot in Exhibit 15.4 graphs the P/E ratio of the S&P 500. You should immediately notice the spikes in 2001 and 2008, when the P/E ratios exceeded 40. This meant that investors considered every $1 of corporate earnings to be the equivalent of $40 in value—much higher than was the case historically. Easier? Yes. Easy? No.

Use the theory on the S&P 500: the historical P/E ratio.

How can you interpret spikes above 40? Start with our theory,

$$\text{Price Now} = \frac{\text{Expected Earnings Next Year}}{\text{Expected Rate of Return} - \text{Eternal Earnings Growth Rate}} \tag{15.2}$$

The 2000 spike should have been due to some combination of earnings growth and expected rates of return on the market.

You can rearrange this two ways:

$$\begin{aligned} \text{Expected Rate of Return} &= \text{Eternal Earnings Growth} + \text{Earnings Yield} \\ \text{Eternal Earnings Growth Rate} &= \text{Expected Rate of Return} - \text{Earnings Yield} \end{aligned}$$

where I have abbreviated the ratio "Expected Earnings Next Year/Price Now" as the earnings yield. Of course, a higher price-earnings ratio implies a lower earnings/price ratio for firms with positive earnings. Therefore, the first formula says that if your P/E ratio goes up, your expected rate of return goes down (if the growth rate of earnings is constant). The second formula says that if your P/E ratio goes up, your expected earnings growth rate also goes up (if the expected rate of return is constant). These are the only two possible explanations for high price-earnings ratios.

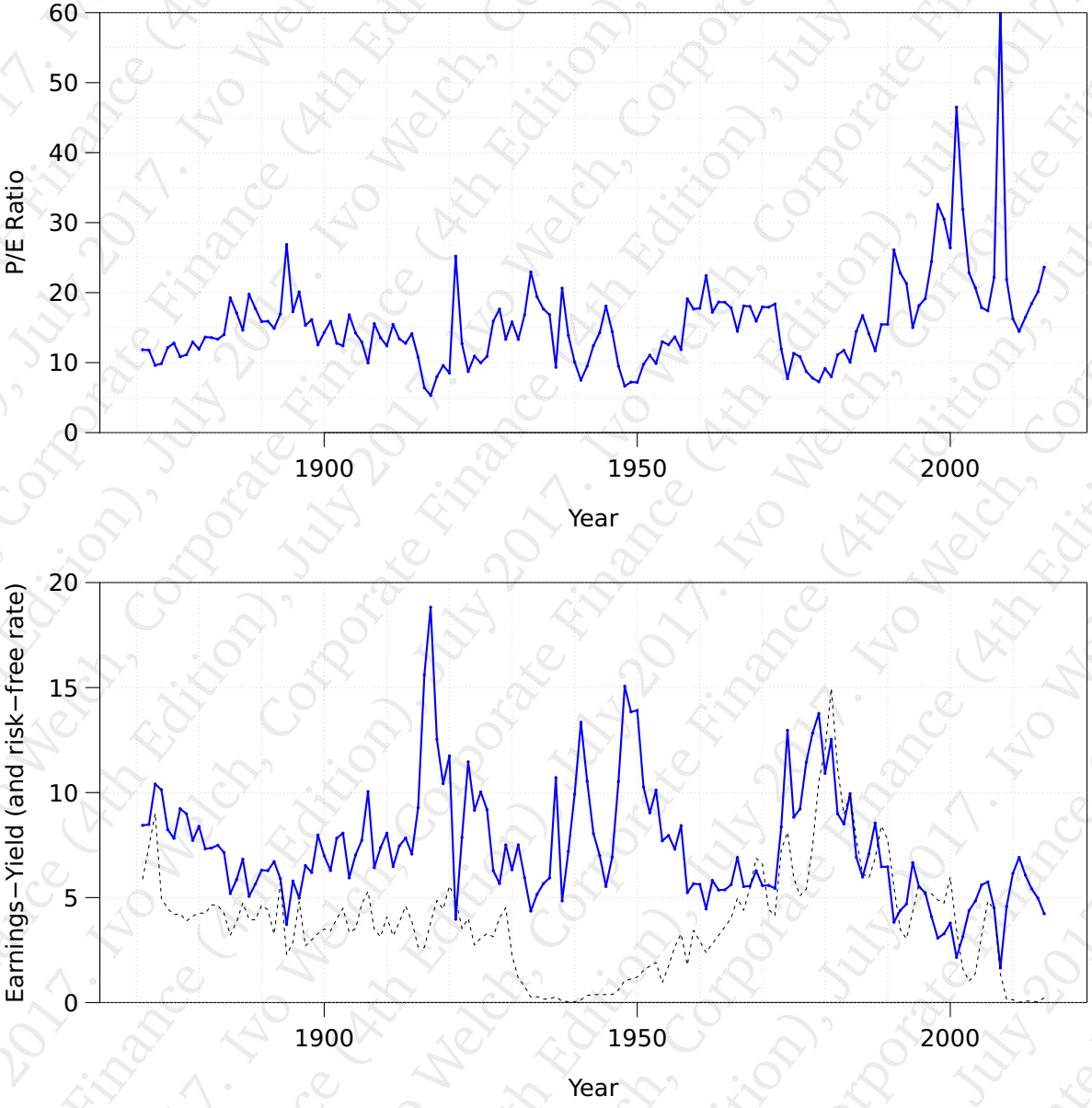

Exhibit 15.4: *The P/E Ratio and E/P Ratio of the S&P 500.* The upper plot shows the history of the price-earnings ratio for the S&P 500. It peaked first in 2001 and again in 2008. (In hindsight, we know that the Great Recession did not turn into another Great Depression.) The lower plot (the earnings yield) is just the inverse, but it also plots the prevailing short-term risk-free interest rate. (The data is available from Amit Goyal's website at HEC Lausanne. His early data is originally from Robert Shiller's book *Irrational Exuberance*. Bob posts the (updated) original data on his website, http://aida.econ.yale.edu/~shiller/.)

Let's put ourselves into investors' shoes at the turn of the millennium, and see how the numbers fit.

Do the numbers fit in 2000 or 2008? Probably not. The P/E ratio was too high to justify high future stock returns, even given aggressive earnings growth.

1. **The earnings yield:** At a P/E ratio of 40, the earnings yield was about 2.5%. No guesswork needed.
2. **The earnings growth rate:** What would have been a reasonable estimate for the eternal growth rate of corporate earnings? Historically, the real (post-inflation) earnings growth rate was about 2%. In 2000, when prevailing inflation was about 1.5%, historical growth rates would have suggested nominal earnings growth rates of about 3.5%. Entertain a (high) range from 3% to 5% for nominal earnings growth rates.
3. **The expected rate of return:** What would have been a reasonable estimate for the rate of return on the stock market? When surveyed in late 1999, investors claimed expected rates of return of 15-20% or more. After all, they had just experienced returns of above 25% per annum over several years in the late 1990s. Let's assume, conservatively, that most investors in early 2000 would have claimed expected rates of return of "only" about 12%, which was the long-run historical average rate of return on the stock market at the time.
4. **Plug it all in:** Pick the lowest expected rate of return on the stock market (12%), the highest corporate earnings growth rate (5%), and the P/E ratio of 40. Plug in these estimates:

$$2.5\% \quad \neq \quad 12\% \quad - \quad 5\%$$

$$\text{Earnings Yield} \quad = \quad \text{Expected Rate of Return} \quad - \quad \text{Eternal Earnings Growth Rate}$$

It doesn't take a sophisticated financier to realize that these numbers do not seem right. Something is wrong. Obviously, it isn't the P/E ratio. Thus, it must have been the case that (a) the expected rate of return was not 12%, but more like 7.5%; (b) the expected growth rate of corporate earnings was not 5%, but more like 9.5%; or (c) some combination of the two.

As for me, I conclude that expectations of future stock returns should have been lower in 2000.

We can narrow this down a little further. The highest *long-run* real growth rate of earnings (at the start of the Industrial Revolution) was no more than 4% per year. Add inflation, and you would estimate the nominal growth rate of earnings to be around 6%—and realize that this means that you would have predicted no less than the equivalent of a second industrial revolution. In fact, this was exactly what analysts at the time were touting to investors: It was the *new economy*, where old rules no longer applied. Even if you had bought into their argument, however, you should still have expected stock market returns of no more than 10% for the formula to add up. In fact, our earlier estimate in Chapter 9 was that a reasonable equity premium should be and should have been around 3%. To estimate the expected rate of return on the stock market, you must add back the Treasury bond yield. In 2000, it had stood at about 5%. This suggested a more reasonable estimate of about 8% as a good expected rate of return on stocks. Investors proclaiming that they were expecting rates of return above 10% must simply have been overoptimistic. This argument was most forcefully advanced by Professor Robert Shiller's best seller, *Irrational Exuberance*. It was published just before the stock market peaked in 2000—good timing, which transformed Bob into an instant market guru and won him a Nobel Prize a few years later. (Bob also called the housing crash of 2007 years in advance. This made him a veritable guru!) But don't get smug: Chapter 12 explained that calling financial markets requires first and foremost a lot of luck. Bob had not just predicted the 2001 and 2008 market declines—he had also predicted many more in the years between.

Q 15.16. Is PVGO usually higher or lower for firms with high P/E ratios? What should it be if E is negative?

Q 15.17. Is the relation between earnings multiples and earnings growth rates usually positive or negative? Is it always so? If not, why not?

Q 15.18. If the P/E ratio on the S&P 500 is 20, given historical earnings growth patterns, what would be a reasonable estimate of long-run future expected rates of return on the stock market?

15.6 Other Financial Ratios

Let's look at financial ratios.

The P/E ratio is just one commonly used financial ratio. There are many others. Most of their users do not understand what their own ratios mean. (For some, neither do I nor anyone else!) They exist primarily because they are easy to calculate. Some ratios can be useful to understanding not only firm value but also other firm characteristics (such as profitability, risk, or precariousness of the business). Sometimes, they help inform you about the economics of the firm, even if they cannot advise you directly about appropriate value of the firm.

Valuation Ratios

A valuation ratio has price in the numerator and something else in the denominator.

A **valuation ratio** has price in its numerator and some measurable attribute in its denominator. The P/E ratio is the most common and typically best valuation ratio, although you should understand by now that it is not a magic bullet (and perhaps not even a paintball). Some other attributes also regularly appear in price-based denominator ratios. Given a chosen valuation attribute, the analyst then finds comparable firm(s) and multiplies the comparables' price/attribute ratios by the firm's own attribute to determine its value. This works well only if firms are similar enough. It is, of course, not possible to write down an exhaustive list of all other valuation ratios. Only the imagination limits the quantities that can be used in the denominator.

Earnings-Based Multiples

You can use different flavors of earnings.

Your ultimate goal is to find a measure that is proportional to value. This means that you may want to use a different form of earnings. Earnings can be defined in a variety of ways: with or without extraordinary items, diluted, and so on. There is no right or wrong way for valuation purposes: Your goal is to find a ratio that makes your comparable firm appear to be as similar as possible to your own firm. You already saw one common alternative measure of earnings in Chapter 14, EBITDA (earnings before interest, taxes, depreciation, and amortization). Its rationale is that accounting depreciation is so fictional that it should not be subtracted out. But EBITDA has problems, too. It does not consider capital expenditures at all. Thus, this measure could suggest the same price-earnings multiple for a firm that reinvests all of its current earnings into capital expenditures (to produce higher future earnings) versus a firm that reinvests none. This is not a good thing.

➤ EBITDA Anecdote, Pg.369.

You can use cash flows, although they are spikier.

In Chapter 14, you also learned that you can subtract off capital expenditures from EBITDA. This approach brings you close to a price/cash flow ratio. Yet such ratios can suffer from the shortcoming that cash flows can be very "lumpy" from year to year. (In a year when the firm makes a lot of fixed investments, the cash flows are often negative—and not reflective of the future.) This is why earnings-based multiples often (but not always) work better than cash-flow-based multiples—and why the latter is therefore more common than the former.

You may also run across a **PEG ratio**, which is the P/E ratio divided by earnings growth. It uses basically the same ingredients as Formula 15.2. The idea behind both formulas is that firms with higher P/E ratios and lower growth rates of earnings are expensive and therefore will produce lower future returns. Unfortunately, the PEG ratio scrambles what it does with these inputs. For example, if the growth rate of earnings is very small, the PEG ratio pretty much produces nonsense. (Interestingly, it has been empirically shown that low-growth firms are the firms that tend to produce higher average market rates of return, not lower rates of return.) My advice: Avoid the PEG ratio.

The PEG ratio is a common real-world statistic. It has the right inputs but puts them together incorrectly.

➤ $r = g + E/P$, Formula 15.2, Pg.405.

Multiples Based on Book Equity (And Book Assets)

The valuation measures so far have divided a market-based snapshot (the stock value) by an accounting flow, either from the income or cash flow statements. Some popular ratios do involve values from the balance sheet, even though many balance sheet figures are known to be unreliable. Thus, if you choose a stock number from the balance sheet as your valuation attribute, you need to be especially suspicious.

Accounting is better at flow measures than stock measures.

➤ Warning about BV stock numbers, Sect. 14.7, Pg.380.

There is one particular balance sheet number that looks very attractive for ratio analysis at first glance: the **book value of equity** (BV of equity, or BVE). Is this a great attribute for the market value of equity (MVE), the number that you want? Unfortunately, usually not. As already explained, the book value is just a plug. (The fact that it can be non-sensibly negative also means that if the book value of equity is in the denominator, the market-to-book equity ratio can suffer from the 1/X domain problem.) The book value of assets suffers from similar, though lesser problems, because book debt values are usually more sensible than book equity values. For older firms, book equity values are often just a fraction of the true equity market values. This means that ratios dividing a flow number by a book value often seem higher, and especially for older firms.

The book value of equity is particularly tempting and problematic.

With all these caveats, I can now tell you about an alternative to price-earnings or price/cash flow ratios: the **market-equity-to-book-equity ratio**. Biased book values in themselves are not a problem. For example, if all firms had book values that are two-thirds of their market values, then the book-to-market ratio would be a perfect valuation attribute. (The ratio method itself would undo the two-thirds bias.) The problem is that different firms have different biases. My advice is this: If you do use a multiple that relies on the book/equity attribute, hoping that similar firms have similar market-to-book ratios, be careful to compare only similarly sized and similarly aged firms. *Do not compare start-up firms to established publicly traded firms.* Of course, non-comparability is a problem with other valuation ratios, too. Thus, a book-to-market ratio can be a useful adjunct to other valuation measures.

The BV versus MV ratio. Older firms have different book value biases than young firms, so don't compare one to the other.

Sometimes, the book value is interpreted as an estimate of physical replacement value—a measure of what the firm is worth as a sum that is above and beyond its individual pieces. This is a very precarious application of book values. My opinion is that, at best, book value helps comparing two similarly aged firms in the same industry with similar histories. If this is the case, then you might learn which of the two seems to have more value than the sum of its parts.

Economic interpretations? Fuggedaboutit

More Esoteric or Specialized Multiples

➤ Real options, Sect. 13.6, Pg.334.

Sometimes you cannot use any of the earnings-based measures. You may have to value a firm that does not have positive earnings, or even positive book equity, or even positive net sales. This is the case for many research firms. They are primarily a bunch of real options.

Many biotech firms have neither earnings nor sales. What can you use?

Price/sales (P/S) ratios: If the firm has negative earnings but positive sales, analysts often resort to a price/sales ratio. Because gross sales are never negative, it largely avoids the 1/X domain problem. (Net sales are almost always but not 100% positive.) The idea is that firms with higher sales should be worth more. This ratio also has another advantage:

P/S has no "negative S" (1/X) domain problem. It may work when P/E fails. (Small sales could still be a problem.)

sales may be more difficult to manipulate than earnings, so it is sometimes used even for firms with positive earnings. However, firms can increase sales and market share at the expense of profitability. If value is based on P/S, the implied value could be higher for firms that pursue bad pricing strategies.

Firms losing money can have great sales.

The P/S ratio remains popular, but it had its heyday during the tech bubble of 1998 to 2000 when few Internet firms had positive earnings. At that time, Amazon sold merchandise at a loss. It was relatively easy to sell $100 bills for $99! Consequently, the more Amazon sold, the more money it lost—and the more valuable it appeared to be. This was perplexing, to say the least.

Rolls-Royce and Ford have similar valuation ratios based on P/E.

Problems with price/sales ratio comparisons are also common in normal times. Some firms have intrinsically low sales, but high profitability. Compare Ford and Rolls-Royce in 2005. Quoting all dollars in billions (and equity in market value),

	Sales	Earnings	Debt	Equity	P/E Ratio
Rolls-Royce	$12	$0.64	$14	$6.5	10.2
Ford Motor	$170	$2.0	$150	$20	10.0

They do not have similar price/sales ratio.

If you valued Rolls-Royce with Ford's P/E ratio, or vice-versa, you would have come up with reasonable valuations. Unfortunately, the same cannot be said for the price/sales ratio. Each dollar of Rolls-Royce sales translated into about 50 cents of equity. Each dollar of Ford sales translated into about 10 cents of equity.

$$\text{P/S}_{\text{Rolls-Royce}} = \frac{\$6.5}{\$12} \approx 0.54$$

$$\text{P/S}_{\text{Ford}} = \frac{\$20}{\$170} \approx 0.12$$

Although both firms are (partly) in the same industry, Rolls-Royce specializes in low-volume, high-value-added niche products at high margins, while Ford follows the opposite strategy. If you mistakenly apply Rolls-Royce's P/S ratio of 0.54 to Ford, you would have overestimated Ford's value at $0.54 \cdot \$170 \approx \$92$ billion, which is off by a factor of four!

Last-resort ratios.

When firms do not have any sales yet, or when all firms' standard financials (earnings, sales, etc.) seem irrelevant to the eventual long-term profitability of the firm, analysts may use even stranger ratios. Here are a few:

Price/employees ratio: This ratio assumes that the employees at the comparable firm are as productive as the employees in the company to be valued. One problem is that this ratio induces firms to hire incompetent employees on the cheap in order to increase their valuations. After all, firms with more employees are presumably worth more.

Price/scientists ratio: As above.

Price/patent ratio: This ratio is another popular technology valuation ratio for scientific firms. Alas, one patent is not the same as another. U.S. Patent #174465 (March 1876) for the Bell telephone was worth a lot more than U.S. Patent #953212 (September 2004) for a "full body teleportation system: a pulsed gravitational wave wormhole generator system that teleports a human being through hyperspace from one location to another." Again, filing patents is cheap. Making meaningful discoveries is not.

Price/anything else: Your imagination is the limit.

If you can, avoid these ratios. In the cases of R&D firms, my advice would be to think about the probability that the company will be successful and its potential cash flows if it will be.

Most non-earnings valuation ratios only make sense if you compute them for the entire value of the firm (that is, the value of all equity plus the value of all liabilities). The reason is that sales, employees, scientists, or patents are firmwide and independent of financing. However, the amount of equity is not. Here is what I mean: Let's assume that Rolls-Royce had been 100% equity-financed, while Ford had remained as is. Rolls-Royce would have been worth about $\$14 + \$6.5 \approx \$20.5$ billion. Each dollar of sales would have translated into equity of $1.71. Applying this ratio directly to Ford's sales would have made you think that Ford's equity should have been worth $1.71 \cdot \$170 \approx \$290$ billion, not $20 billion. *A price/sales ratio in which the price is equity is garbage.* If you decide that you want to use a price/sales ratio, then work only with the full-firm-value-to-sales ratio, not the equity-value-to-sales ratio.

Most other ratios cannot be used to value equity, only to value assets.

How does this situation compare with price-earnings ratios? Although P/E ratios also change with the debt ratio, the change is relatively mild. A simple sanity condition still applies: A firm with more debt financing has both a lower price of equity and lower earnings. Both the numerator and denominator change together.

Firms with more debt have lower equity and lower earnings.

Q 15.19. When would you use a price/sales ratio? Why?

Q 15.20. Why are price/sales ratios problematic?

Q 15.21. In June 2016, YAHOO! FINANCE reported the following statistics:

	KO	DPS	PEP	Nestlé
Market Cap	191	18	147	
Employees (in k)	123	19	263	335
Revenue (ttm)	44	6	63	92
EBITDA (ttm)	12	1.6	12	15
Net Income (ttm)	7.3	0.8	5.2	9.3

Nestlé is not a traded company, but a Swiss anonymous society. What do you think it is worth?

Q 15.22. On July 28, 2003 (all quoted dollars are in billions), the three soda producers had the following financials:

Firm	Cash	Sales	Dividends	Value	D/E
CSG	N/A	$9.2	$0.4	$12.2	153%
KO	$3.6	$20.3	$2.2	$110.8	43%
PEP	$1.8	$25.9	$1.1	$81.0	22%

Hansen Natural had $210,000 in cash, $9.22 million in sales, zero dividends, and a debt-equity ratio of 10%. What would a price/cash ratio predict its value to be? What would a price/sales ratio predict? What would a price/dividend ratio predict? Elaborate on some shortcomings.

Nonvaluation Diagnostic Financial Ratios

Many other ratios are commonly used for judging such factors as financial health and profitability.

Not all ratios are used to estimate firm value. Some ratios can help you assess a firm's financial health and profitability—or they can be merely interesting. They can assist you in the "art" of valuation if they can help you learn more about the economics of the firm. For example, some ratios are commonly used to judge proximity to bankruptcy, others to judge profitability. Like valuation multiples, many ratios are reasonably similar *within* an industry, but not *across* industries. They also often vary over the business cycle. Thus, they should only be compared to similar firms at the same time. Nevertheless, on occasion, ratios can be so extreme that they can raise a good warning flag. For example, if you find that the firm has 10 times its earnings in interest and principal payments due, you might become somewhat concerned about the possibility of bankruptcy, regardless of what the standard in the industry is at the time.

Quick recap of stock numbers.

First, a short recap of some important balance sheet numbers for Intel:

	Book Value					Market Value
INTC, 2015	Total Assets	Stock Equity	Total Liabilities	Financial Debt	Financial Capital	Common Equity
In billions	$103.1	$61.1	$41.1	$20.0+$2.6	$83.7	$162.6

Sometimes, analysts use not just common stock equity, but all equity (including preferred equity). These days, few large publicly traded firms issue preferred equity, so this rarely makes much difference. In this case, Intel had no preferred equity. Financial debt is the sum of long-term debt ($20.0) and debt in current liabilities ($2.6), which adds up to $22.6 billion. Total liabilities are $41.1 billion, which can also be computed by subtracting book equity from book assets, $103.1 – $61.1. In addition to financial debt, total liabilities include such obligations as current liabilities, pension liabilities, and the like.

➤ Preferred equity, Pg.435.

On December 31, 2015, INTC had 4.719 billion shares outstanding and a closing price of $34.45 for an equity market cap of $162.6 billion. The enterprise value is the market cap of the firm plus debt etc., minus cash. Here, it is $162.6 plus $22.6 minus $15.3 (cash) or $169.9. The **market value of the firm** (not of the equity) is total assets minus book equity plus market equity, or $204.6 billion. It takes a moment longer to obtain the market value, because the numbers used to compute it are not on the balance sheet, but have to be computed from the prevailing stock price. Laziness contributes as much to the wide use of book value as ignorance. As for debt, we can use the book value of debt not because we prefer it, but because the market value of *debt* is never easily available; and fortunately, the book value of debt (unlike that of equity) is often reasonably close to its market value.

➤ Balance Sheet and Capital Structure, Exhibit 14.1, Pg.358.

You can now compute ratios for Intel.

Without further ado, here are some of the more interesting and common ratios. The sample calculations for Intel are based on the financials from Section 14.1. Be aware that many of these ratios exist in various flavors. The ratios are sorted, so that those in the beginning tend to reflect financial health and liquidity, while those at the end tend to reflect profitability. (Investopedia.com offers a nice reference for many of these ratios.)

➤ Intel Financials, Sect. 14.1, Pg.357.

Measures of Leverage and Financial Precariousness

Debt-related (potentially distress-related) ratios.

We begin with ratios that reflect the firm's debt load. A firm that has high debt ratios (especially compared to those of its industry) must often be especially careful to manage its cash stock and cash flows well in order to avoid a credit crunch. Moreover, if it wants to borrow more money, then potential new creditors often use such ratios to judge whether the firm will default. They will often judge indebtedness relative to profitability, cash flow, and industry.

The debt-equity ratio and liabilities-equity ratio come in many variations. For example, the long-term debt-equity ratio is defined in terms of market value of equity:

$$\text{INTC, 2015: } \frac{\text{Long-Term Debt}}{\text{Market Value (MV) of Equity}} = \frac{\$20.0}{\$162.6} \approx 12\%$$

The broader financial debt-equity ratio is

$$\text{INTC, 2015: } \frac{\text{Financial Debt}}{\text{Market Value (MV) of Equity}} = \frac{\$22.6}{\$162.6} \approx 14\%$$

Even broader,

$$\text{INTC, 2015: } \frac{\text{All Liabilities}}{\text{Market Value (MV) of Equity}} = \frac{\$41.1}{\$162.6} \approx 67\%$$

Some analysts use the book value of equity, which you can find on the balance sheet. For example,

$$\text{INTC, 2015: } \frac{\text{Financial Debt}}{\text{Book Value (BV) of Equity}} = \frac{\$41.1}{\$61.1} \approx \%$$

It is common that the book-based ratio makes the debt ratio appear larger. I have already explained why I cannot recommend book-value-based equity ratios. But intuitively, too, it is difficult to think of Intel, a firm with an equity market cap of almost $163 billion, as being worth only $61 billion and thus having so high a debt ratio.

➤ Warning about BV stock numbers, Sect. 14.7, Pg.380.

Debt ratios add the value of debt to the denominator. Because the market value of debt is not available, we again add the book value of debt and the market value of equity. For example,

$$\text{INTC, 2015: } \frac{\text{BV of Long-Term Debt}}{\text{MV of Equity + BV of LTDebt}} = \frac{\$20.0}{\$162.6 + \$20.0} \approx 11\%$$

or

$$\text{INTC, 2015: } \frac{\text{All Liabilities}}{\text{MV of Equity + All Liabilities}} = \frac{\$41.1}{\$162.6 + \$41.1} \approx 20\%$$

Some analysts use book instead of market value of assets, which again tends to produce higher ratios.

You may also run into a definition for the firm's debt ratio that divides financial debt by total assets. (This is usually computed with book values. For Intel, this would be $22.6/($20 + $162.6) ≈ 11%.) Unfortunately, this measure is as common as it is wrong. Consider two simple firms:

Please avoid debt divided by assets as a measure of leverage.

	Financial Debt	Nonfinancial Liabilities	Book Equity	Debt Ratio
Firm A	$100	—	$100	50%
Firm B	$100	$300	$100	20%

Firm A has the same financial debt and equity as firm B. It is also clearly financially more solid and less indebted. Nevertheless, the financial-debt-to-asset ratio incorrectly shows a much *higher* debt ratio. (The underlying problem is that equity is not the opposite of financial liabilities; instead, equity and other financial liabilities together are the opposite.)

Times interest earned (TIE) is often used to gauge long-term solvency. It is computed as earnings before interest (usually also before taxes) divided by the firm's interest. It is the inverse of interest coverage, so a lower number means the firm's debt burden is more precarious.

$$\text{INTC, 2015: } \frac{\text{Operating Income}}{\text{Interest Payments}} = \frac{\$14.0}{\approx \$0} \gg 100$$

Intel had negligible net interest payments—indeed, it earned as much or more interest on its cash holdings as it paid on its debt. If you use net interest payments in the denominator, you run into the 1/X problem.

The definition of interest coverage can be ambiguous. The most common definition here is identical to TIE. (It is also occasionally defined as its inverse: the ratio of debt payments due, as a fraction of cash flows or EBIT.) Many variations exist: Debt payments can be only interest due, or include both principal and interest. Cash flows can be any of a number of choices. Popular choices are cash flows, operating and investing cash flows, only operating cash flows, net income plus depreciation minus capital expenditures, and (yikes) net income plus depreciation.

$$\text{INTC, 2015: } \frac{\text{Interest Expense} - \text{Interest Income}}{\text{Operating Cash Flow}} = \frac{-\$105}{\$14} < 0$$

The current ratio is the ratio of **current assets** (cash, accounts receivable, inventory, marketable securities, etc.) over **current liabilities** (soon-due interest, accounts payable, short-term loans payable, etc.). It is a measure of short-term liquidity.

➤ Working Capital, Sect. 14.4, Pg.374.

$$\text{INTC, 2015: } \frac{\text{Current Assets}}{\text{Current Liabilities}} = \frac{\$40.4}{\$15.7} \approx 2.6$$

The current ratio is often interpreted as "healthy" if it is greater than 1.5. This means that each $1 of current liabilities is covered by $1.5 in current assets. Do not read too much into this threshold. For some firms, a low current ratio means good and lean operations. For others, it means precarious operations.

The quick ratio (or acid ratio) is similar to the current ratio but deletes inventories from current assets. The idea is that a firm with a high quick ratio can cover immediate expenses with immediate income. Inventory is subtracted, because unlike the other components of working capital, it still needs to be sold to turn into cash quickly.

$$\text{INTC, 2015: } \frac{\text{Current Assets} - \text{Inventories}}{\text{Current Liabilities}} = \frac{\$40.4 - \$5.2}{\$15.7} \approx 2.2$$

The acid ratio is often considered "healthy" if it is greater than 1.0 (which is sometimes called the acid test). Again, for Intel, this ratio is fairly unimportant. The **cash ratio** further eliminates receivables from current assets.

Duration and maturity are not indebtedness ratios, but they can be helpful.

Duration and maturity were explained in the context of bonds, but they can also be applied to projects and even to firms. They can measure whether the firm is making short-term or long-term investments. This is not an ordinary ratio, in that it requires projections of future cash flows.

➤ Duration, Sect. 5.1, Pg.80.

Now come measures that are more profitability- and efficiency-based.

Many turnover ratios divide sales by another number, usually a component of net working capital. (A variant uses "cost of goods sold" instead of sales as the numerator.)

- **Inventory turnover** measures how often your inventories translate into sales.

$$\text{INTC, 2015: } \frac{\text{Net Sales}}{\text{Inventories}} = \frac{\$55.4}{\$5.2} \approx 11 \text{ times (per year)}$$

  A high ratio usually means efficient inventory management. Most financials also provide the components of inventories, so you could further decompose this ratio. (Of course, firms can also manipulate this ratio not by improving efficiency, but by selling their inventories at a discount.)
- **Receivables turnover** measures how quickly your customers are paying you.

$$\text{INTC, 2015: } \frac{\text{Net Sales}}{\text{Receivables}} = \frac{\$55.4}{\$6.8} \approx 8 \text{ times (per year)}$$

- **Payables turnover** measures how quickly you are paying your suppliers.

$$\text{INTC, 2015: } \frac{\text{Net Sales}}{\text{Payables}} = \frac{\$55.4}{\$10.8} \approx 5 \text{ times (per year)}$$

These measures are sometimes inverted (1 divided by the ratio) and multiplied by 365 to obtain a "number of days" measure. For example,

- **Days receivables outstanding** (**DRO**), also called **days of sales outstanding** (**DSO**) or **average collection period**. To compute DRO, divide accounts receivable by total sales on credit and multiply by the number of days per year.

$$\text{INTC, 2015: } \frac{365 \text{ Days} \cdot \text{Receivables}}{\text{Net Sales}} = \frac{365 \text{ Days} \cdot \$6.8}{\$55.4} \approx 45 \text{ Days}$$

  Intel collects its bills after about six weeks. A lengthening of this number could indicate that customers are running into financial difficulties and the firms may want to reconsider their credit policies.
- **Days inventories outstanding** is inventory divided by total sales on credit, times number of days outstanding.

$$\text{INTC, 2015: } \frac{365 \text{ Days} \cdot \text{Inventories}}{\text{Net Sales}} = \frac{365 \text{ Days} \cdot \$5.2}{\$55.4} \approx 35 \text{ Days}$$

  Intel turned over its inventory every month.
- **Days payables outstanding** (**DPO**) is accounts payable divided by total sales on credit, times number of days outstanding.

$$\text{INTC, 2015: } \frac{365 \text{ Days} \cdot \text{Payables}}{\text{Net Sales}} = \frac{365 \text{ Days} \cdot \$10.8}{\$55.4} \approx 71 \text{ Days}$$

  A lengthening of this number could mean either that a firm has difficulties coming up with cash to meet its financial obligations or that it has found a way to pay bills more efficiently (more slowly in this case).

There are also combined versions, such as the **cash conversion cycle**, which is the sum of the inventory-processing period and the number of days needed to collect receivables, minus the number of days the firm takes to pay its suppliers.

Turnover ratios and their derivatives (below) are especially important for firms in the commodities and retail sectors, such as Wal-Mart. Good turnover control often allows firms to deploy economies of scale. In this sense, the above ratios measure corporate efficiency, which can help managers judge their own efficiency relative to that of their competition.

Measures of Profitability

Next are some accounting methods to compute margins or returns.

The list.

The net profit margin (NPM) or return on sales (ROS) is the net income divided by sales.

$$\text{INTC, 2015: } \frac{\text{Net Income}}{\text{Sales}} = \frac{\$11.7}{\$55.4} \approx 21\%$$

Intel could translate about 21 cents of every dollar sold into net income. Analysts also sometimes use other measures of income. For example, when they work with operating income instead of net income, the resulting measure would be called an **operating profit margin**. The gross profit margin uses gross income instead of net income.

Many growth firms have uninterpretable margins, because they may have practically no income and no sales.

The return on (book) assets (ROA) divides net income by the book value of assets.

$$\text{INTC, 2015: } \frac{\text{Net Income}}{\text{BV of Assets}} = \frac{\$11.7}{\$103.1} \approx 11\%$$

A variant of this measure that adds back interest expense is better, because it recognizes that assets pay out cash to both shareholders and creditors. Nevertheless, both measures are dubious, because the book value of assets contains the book value of equity and is therefore unreliable. You can think of the E/P yield as a better, market-based ROA measure.

➤ Warning about BV stock numbers, Sect. 14.7, Pg.380.

The return on (book) equity (ROE) divides net income by the book value of equity. You also know by now that I *really* do not like book-equity-based measures. Avoid

$$\text{INTC, 2015: } \frac{\text{Net Income}}{\text{BV of Equity}} = \frac{\$11.7}{\$61.1} \approx 19\%$$

Total asset turnover (TAT) measures how much assets are required to produce sales. Again, with book value of assets in the denominator, this is not a reliable ratio.

$$\text{INTC, 2015: } \frac{\text{Sales}}{\text{BV of Assets}} = \frac{\$55.4}{\$103.1} \approx 53\%$$

Timing when stock and flow measures are both included.

For ratios in which both the numerator and the denominator are flows, such as the ROS ratio, we use the same time period for both. But for ratios with one flow and one stock, such as ROA and ROE, you have a choice. You can divide ROA (or ROE) by the assets (or equity) at the start of the period, at the end of the period, or even by an average of the two.

The DuPont model—a legacy from a time before modern finance. It is still commonly used, although it explains a measure that is not meaningful to begin with.

The so-called **DuPont model** multiplies and divides a few more quantities into the definitions of ROA and ROE in an attempt to learn more about the drivers of value.

$$\text{ROE} = \frac{\text{Net Income}}{\text{BV of Equity}} = \underbrace{\frac{\text{Net Income}}{\text{Sales}}}_{\text{Profit Margin}} \cdot \underbrace{\frac{\text{Assets}}{\text{Book Equity}}}_{\text{BV of Multiplier}} \cdot \underbrace{\frac{\text{Sales}}{\text{Assets}}}_{\text{Asset Turnover}}$$

A similar operation can be applied to a variant of ROA:

$$\text{ROA} = \frac{\text{EBIAT}}{\text{Assets}} = \frac{\text{EBIAT}}{\text{Sales}} \cdot \frac{\text{Sales}}{\text{Assets}}$$

where EBIAT is earnings before interest after taxes. Your immediate question should be, "Why should you care about any decomposition of ROE or ROA in the first place?" Both measures are based on the book value of equity, which Section 14.7 pointed out as having severe problems. Your second question should be, "Can you trust the components of this decomposition, at least one of which also includes the book value of equity?" Then hope that the error in your comparable firms' book values of equity is in the same direction as your own. In this case, the DuPont model may usefully inform you about what you can do to raise ROE or ROA. For example, everything else equal, if you can increase your asset turnover, it is likely that your ROE will increase. Your third question should be, "Why am I bothering you with this?" I can answer this one more easily: The individuals administering the CFA exam keep the DuPont model alive as one of their staples, and you may even run into some obsolete corporate treasurers who still use it.

Measures Related to Stock Market Capitalization

Measures that are more oriented toward shareholders and the stock market.

Let us now proceed to measures that are more oriented toward the stock market.

The book-to-market ratio is the inverse of the book equity-based valuation multiple. If you get very lucky (and don't count on it), the book value of assets hints at how much the assets would cost to replace. (By the way, your chances are better if the firm is very young and assets have not yet been accounting-depreciated.) If you are indeed lucky, then this book-equity-to-market-equity ratio can be interpreted as a measure of how much market value the firm has created via its unique growth opportunities.

$$\text{INTC, 2015: } \frac{\text{BV of Equity}}{\text{MV of Equity}} = \frac{\$61.1}{\$162.6} \approx 37\%$$

However, in Intel's case, it is more likely that the book value of its equity is simply a number without much meaning. Intel owns tangible and intangible assets—both accounted for by the accountants—that are worth far more than their book values.

The dividend payout ratio measures what percent of earnings is paid out as dividends. Holding everything else equal, the same firm that pays out more of its earnings today would pay out less in the future. (If it had retained earnings, it would have earned more cash for payout later.)

$$\text{INTC, 2015: } \frac{\text{Dividends}}{\text{Net Income}} = \frac{\$4.6}{\$11.4} \approx 40\%$$

The payout ratio expands the payout from only dividends to include share repurchases, or even net repurchases (i.e., share repurchases net of share issues).

$$\text{INTC, 2015: } \frac{\text{Dividends + Equity Repurchasing}}{\text{Net Income}} = \frac{\$4.6 + \$1.8}{\$11.4} \approx 51\%$$

There are versions with or without net issuing activity.

The dividend yield is the amount of dividends divided by the share price. Dividends are a flow measure, whereas the stock price is a stock measure. Consequently, dividends can be measured relative to the price at the beginning or the end of the period. In the latter case, it is called the **dividend-price ratio**.

➤ Dividend yield, Sect. 2.3, Pg.13.

➤ Equity payouts, Chapter 20, Pg.555.

$$\text{INTC, 2015: } \frac{\text{Dividends}}{\text{MV of Equity}} = \frac{\$4.6}{\$162.6} \approx 2.8\%$$

Equity repurchases are also payouts to shareholders, so you can enlarge this measure to a payout/price ratio,

$$\text{INTC, 2015: } \frac{\text{Dividends + Equity Repurchasing}}{\text{MV of Equity}} = \frac{\$4.6 + 1.8}{162.6} \approx 3.9\%$$

The earnings retention ratio is changes in retained earnings (i.e., this year's earnings that were not paid out), divided either by sales, assets, or income. All else equal, a firm that retains more earnings today should pay out more in the future. After all, the retained earnings should be reinvested, so such firms should have higher expected earnings growth. Retention ratios are usually calculated as 1 minus the dividend payout ratio, 1 minus the sum of dividends and equity repurchases divided by net income, or 1 minus the sum of dividends and net equity repurchases divided by net income. For example, for Intel

$$\text{INTC, 2015: } \frac{\text{Net Income – Payout}}{\text{Net Income}} = \frac{\$11.4 - (\$4.6 + 1.8)}{11.4} \approx 44\%$$

You can easily think of variations here, such as inclusion or exclusion of preferred stock payments, and so on.

How useful are these ratios? It depends on the situation, the industry, and the particular ratio for the particular firm—and what you expect to learn. If every firm in the industry has almost the same ratio—for example, days of receivables average somewhere between 25 and 32 days everywhere, but the firm in which you are considering investing reports 7 days—you should wonder about the economics of this shorter number. Is your firm better in obtaining money quickly? Does it do so by giving rebates to faster paying customers? Does it mostly work on a cash basis, while other firms in the industry work on credit? If so, why? Or is your firm simply cooking its books?

The ratios can be useful, but please don't live by them.

Q 15.23. How would you measure a financial-debt-equity ratio?

Q 15.24. What is the "current ratio"? Is a firm more or less precarious if this ratio is high?

Q 15.25. A firm has sales of $30,000 and receivables of $6,000. What is its receivables turnover? What is its DRO?

Q 15.26. What is the difference between the dividend-price ratio and the dividend payout ratio?

Summary

Should you estimate value based on comparables or net present value? In practice, comparables enjoy great popularity, primarily because a minimal application does not require much thought. Anyone can look up another firm's P/E ratio and multiply it by the earnings of the firm to be valued. In contrast, even a rough NPV analysis is quite involved. Of course, after reading this chapter, you should understand that both methods have problems. You will never have the perfect comparable, and you will never know the correct expected future cash flows. Fortunately, the cause of errors is different for these two methods. Therefore, if you use both, you can often get a better idea of where the most accurate value assessment lies. This does not mean that you should average the valuation estimates obtained from NPV and comparables. Instead, you should perform both analyses and then take a step back and make up your mind as to which combination of methods seems to make the most sense in your particular situation. Yes, valuation is as much an art as it is a science. It consists of the tools that you have learned *and* your ability to judge. If you can judge better than others, you will end up rich.

This chapter covered the following major points:

- Comparables can provide an alternative valuation of firms and projects. The comparables valuation techniques and estimated NPV have different weaknesses, which therefore often makes it worthwhile to contemplate both.
- A comparables analysis relies on three assumptions:
  - The identification of good value-relevant attribute(s)
  - The identification of good comparable firms with known market values
  - The law of one price
- The most common value attribute is earnings, making the P/E ratio the natural way to infer value. The P/E ratio divides the price of the firm by its earnings. This can be done with aggregate firm numbers or on a per-share basis.

  Forward earnings are usually better than trailing earnings in comps.
- All else equal, higher-growth firms have higher P/E ratios.
- Comparables suffer from many problems. Some can be corrected, others cannot.
- You cannot mechanically average P/E ratios. This can lead to all sorts of strange implications. Don't take P/E ratios too literally.
- The 1/X domain problem is toxic. Use one of the suggested techniques (such as using the median, ignoring firms with nonpositive earnings, averaging E/P ratios, or working with sums) to reduce its influence. None of these ad-hoc remedies are attractive but they are better than none, and if you use P/E, what other choice do you have?
- There are also many other ratios that can be used to judge the profitability and the financial health of a company. These ratios can sometimes provide useful background information.

Keywords

Acid ratio, 414. Average collection period, 415. Book value of equity, 409. Book-to-market ratio, 416. Cash conversion cycle, 415. Cash ratio, 414. Current assets, 414. Current liabilities, 414. Current ratio, 414. DPO, 415. DRO, 415. DSO, 415. Days inventories outstanding, 415. Days of sales outstanding, 415. Days payables outstanding, 415. Days receivables outstanding, 415. Debt-equity ratio, 413. Dividend payout ratio, 417. Dividend yield, 417. Dividend-price ratio, 417. DuPont model, 416. Duration and maturity, 414. Earnings retention ratio, 417. Earnings-price yield, 399. Forward earnings estimate, 392. Interest coverage, 414. Inventory turnover, 414. Liabilities-equity ratio, 413. Market value of the firm, 412. Market-equity-to-book-equity ratio, 409. NPM, 415. Net profit margin, 415. Operating profit margin, 415. P/E Ratio, 388. P/E, 388. PEG ratio, 409. PVGO, 395. Pair trading, 404. Payables turnover, 415. Payout ratio, 417. Price-earnings ratio, 388. Quick ratio, 414. ROA, 415. ROE, 416. ROS, 415. Receivables turnover, 414. Return on (book) assets, 415. Return on (book) equity, 416. Return on sales, 415. TIE, 413. TTM, 401. Times interest earned, 413. Trailing earnings estimate, 392. Trailing twelve month, 401. Turnover ratio, 414. Valuation ratio, 408.

Answers

Q 15.1 The law of one price states that items with similar attributes should be priced similarly.

Q 15.2 Comparable projects enter the NPV formula through the (opportunity) cost of capital, also called the discount rate, usually abbreviated $\mathsf{E}(r)$.

Q 15.3 It is more common to compute a price-earnings ratio than a price/cash flow ratio because the earnings measure incorporates some forward-looking information, and is therefore less "spiky."

Q 15.4 Google is growing faster than PepsiCo, so it should have a higher P/E ratio. Alas, in mid 2016, both GOOG and PEP stood at P/E ratios of 30. Go figure. Theory is easier than practice.

Q 15.5 $E/P = \mathsf{E}(r) - \mathsf{E}(g) \Rightarrow \mathsf{E}(r) = E/P + \mathsf{E}(g) = 1/40 + 6\% = 8.5\%$. Therefore, $E/P = 8.5\% - 7\% = 1.5\%$ and its P/E ratio would shoot from 40 to 66.7. The percentage change in value would therefore be $66.7/40 - 1 \approx 67\%$.

Q 15.6 Rearranging Formula 15.1,

$$\frac{\text{Price}}{\text{Expected Earnings}} = \frac{1}{\text{Cost of Capital}} + \frac{\text{PVGO}}{\text{Expected Earnings}}$$

It states that firms with zero PVGOs have E/P yields equal to their costs of capital. Firms that are growing have E/P yields below their costs of capital. Firms that are shrinking have E/P yields above their costs of capital.

Q 15.7 If PVGO is positive, $\mathsf{E}(g)$ is also positive.

Q 15.8 For the stable firm:

1. The P/E ratio is $\$1{,}000/\$100 = 10$.
2. The debt now has to receive $\$500 \cdot 7.5\% = \$37.50$ in interest every month. Therefore, there is \$62.50 available to the equity. Therefore, the P/E ratio is $\$500/\$62.50 = 8$.
3. The increase in debt has decreased the firm's P/E ratio.

Q 15.9 The P/E ratio of the merged A and B company is neither the equal-weighted nor the value-weighted average! See Section 15.4.

Q 15.10 Let's do an example. The acquirer has value of \$100, so it needs to have earnings of \$5. The target has value of \$50, so it needs to have earnings of \$1. This means that the combined firm will have earnings of \$6 and value of \$150. Its P/E ratio will thus be 25.

Q 15.11 Averaging P/E ratios is very hazardous because it can easily lead to misleading estimates, as explained in Section 15.4. We called it the "1/X domain problem." The main problem is that earnings can be nonpositive or tiny.

Q 15.12 If only one among a dozen industry comps has a negative P/E ratio, you can ignore this firm with nonpositive earnings, you can use the median industry ratio, you can work with E/P yields and invert them, or you can work with sums of prices and sums of earnings—or all of the above.

Q 15.13 This can change year by year.

Q 15.14 This question about the unlevered P/E ratio cannot be answered if you do not know the different costs of capital. For example, if the firm's cost of capital is equal to the debt cost of capital, the P/E ratio would not change at all!

Q 15.15 Yahoo! Germany reported an actual market value of \$10.52 billion euros and an earnings yield of 36.9% (P/E of 27). The easy part is supplementing the table:

Manufacturer	Mkt Cap	Earnings	P/E Ratio	E/P Yield
Volvo (ADR)	$5.7	–$0.18	–31.7	–3.2%
Ford	$14.1	–$5.30	–2.7	–37.6%
GM	$18.8	$1.83	10.3	9.7%
Nissan (ADR)	$27.0	$2.55	10.6	9.4%
DaimlerChrysler	$32.3	$4.63	7.0	14.3%
Honda (ADR)	$37.7	$3.09	12.2	8.2%
Toyota (ADR)	$87.3	$4.51	19.4	5.2%
Sum	$222.9	$11.13	25.1	6.0%
Average	$31.8	$1.59	3.6	0.9%

The hard part is deciding on a suitable P/E comparable. Our first method (average E/P yield, then invert) suggests adopting the astronomical ratio of $1/0.9\% \approx 111$, due to Ford's enormous loss in terms of market capitalization (Ford had $85 billion in sales and a positive EBITDA of $4.8 billion. But Ford also has ongoing depreciation on the order of $15 billion per year, but capital and other expenditures on the order of $18 [2001] to $37 billion [2000 and 1999].) Our second method (sum up Es and Ps first) suggests $\$222.9/\$11.13 \approx 20$, but it weighs the larger (and Japanese) firms more highly. Nevertheless, in this case, the second method came closer to the actual Volkswagen P/E multiple of 27. Incidentally, by mid-2003, VW had introduced a couple of flops and its earnings had sagged to $2.5 billion, though its market capitalization had increased to $15 billion. This meant that Volkswagen's P/E multiple had shrunk from 27 to 6 in just 9 months! As to assumptions, they all fall into the category of "apples like apples." For example, you are assuming (hoping) that leverage ratios are similar, foreign earnings are comparable, timing is the same, and so on.

Q 15.16 Firms with high P/E ratios usually have higher PVGOs. Using the formula in Exhibit 15.2, you can see that

$$\frac{\text{PVGO}}{\text{Price}} = 1 - \frac{1}{\mathsf{E}(r) \cdot \text{P/E ratio}}$$

Intuitively, firms with negative earnings should be worth less than nothing if it were not for their PVGOs.

Q 15.17 The relation between earnings multiples and earnings growth rates is usually negative. It is not always so, because it is not stable over the business cycle. During recessions, cash cow firms may actually trade at higher multiples than (precarious) growth firms. In a sense, as indicated by the formulas, economic recessions can transform what were previously growth firms in growing markets into dying firms!

Q 15.18 With a P/E ratio of 20 on the S&P 500, its E/P yield would be around 5%. The real earnings growth rate has been around 2%. Thus, the real stock market rate of return would be around 7%. Add inflation, and you get an estimate of the nominal rate of return on the stock market.

Q 15.19 You would use a price/sales ratio if earnings are negative and/or you believe that sales are more representative than earnings of the future value of the firm.

Q 15.20 Firms can increase sales at the expense of profitability. (Just sell goods for a very low price.) Moreover, you should never compute a P/S ratio for equity. Instead, you should only compute the P/S ratio for the entire firm.

Q 15.21 We could consider different benchmark metrics according to what we have here.

	KO	DPS	PEP	Nestlé ?
Market Cap / Employees (in k)	1.6	0.9	0.6	1
Market Cap / Revenue (ttm)	4.4	3.0	2.3	3
Market Cap / Net Income (ttm)	26	23	28	25

These are rough estimates, of course. Nestle should be worth about $300 billion in terms of its number of employees (if it is not merely bloated), $280 billion in terms of its revenues, and $250 billion in terms of its net income.

Q 15.22 The price/cash ratio, price/sales ratio, and price/dividend ratio are usually calculated without debt adjustment—the equivalent of surgery without anesthesia. This is a huge problem, but it also makes this exercise relatively easy.

Firm	Value/Cash	Value/Sales	Value/Dividends
CSG	N/A	1.3	31
KO	31	5.5	50
PEP	45	3.1	74

- The cash-based ratio suggests a value between $6.5 million and $9.5 million. The cash-based ratio values all firms as if only current cash has any meaning, and the ongoing operations are irrelevant (except to the extent that they have influenced current cash).
- The sales-based ratio suggests a value between $12.0 million, $28.6 million, and $50.7 million. Because the smaller comparables have lower ratios, one might settle on a lower value. The sales-based ratio ignores that CSG's equity value is relatively low because more of its value is capitalized with debt than with equity.
- The dividend-based ratio suggests a zero value. Obviously, this is not a perfect estimate. Firms can choose different payout policies.

Hansen's actual value on this day was $51.4 million.

Q 15.23 A common financial-debt-equity ratio computes the sum of long-term debt plus debt in current liabilities, divided by the sum of the market value of the firm's equity.

Q 15.24 The current ratio is the ratio of current assets over current liabilities. A firm is less precarious if this ratio is high. (However, too high of a current ratio may mean that the firm is investing too much in short-term assets, which typically yield less.)

Q 15.25 Its receivables turnover is $\$30{,}000/\$6{,}000 = 5$ times per year. DRO is $365 \cdot \$6{,}000/\$30{,}000 = 73$ days.

Q 15.26 The dividend-price ratio divides dividends by price; the dividend payout ratio divides dividends by net income.

End of Chapter Problems

Q 15.27. What are the three main requirements for a comps-based valuation?

Q 15.28. When negotiating house prices, would you value your next residence by the method of comparables or by the method of NPV? If comparables, what kind of ratio might you use?

Q 15.29. Is it better to compute a price-earnings ratio on a per-share or aggregate (total value) basis?

Q 15.30. Is it better to use cash flows or earnings in your valuation multiple? Why?

Q 15.31. Which is likely to have a higher price-earnings ratio: Google or Exxon?

Q 15.32. Pick 8 firms in the "department stores" sector. Using a financial website (e.g., YAHOO! FINANCE), graph next year's expected growth of earnings against the firms' earnings/price yield. Is there a relation?

Q 15.33. Assume that the prevailing interest rate is 8% per year for value firms and 12% per year for growth firms. A growth firm with earnings of $100,000 has a market value of $100,000,000, while a value firm with earnings of $1,000,000 has a market value of $20,000,000.

1. What are the implicit growth rates?
2. What are the PVGOs?

Q 15.34. Consider a growing firm that is expected to produce earnings of $10 million next year. The firm's earnings growth rates are 15% per annum. The firm's cost of capital is 20%. Its tax rate is 0.

1. What is the market value of this firm?
2. What is the firm's P/E ratio if it has no debt?
3. Now assume that the cost of capital for debt of $100 million is 8%, while the cost of capital for the remaining levered equity is 32%. (Again, the weighted average cost of capital is $50\% \cdot 8\% + 50\% \cdot 32\% = 20\%$, so the firm's cost of capital has not changed.) Interest on the $100 million debt is paid out. What is the equity's P/E ratio now?
4. Has the increase in debt increased or decreased the firm's P/E ratio?

Q 15.35. If the P/E ratio on the S&P 500 is 10, given historical earnings growth patterns, what would be a reasonable estimate of long-run future expected rates of return on the stock market? Assume a long-run inflation rate of 2.5% per annum.

Q 15.36. A firm has earnings of $200, and a price/ earnings ratio of 20. What is its implied growth rate, if its cost of capital is about 10%?

Q 15.37. Redo Shiller's value analysis today. Find the current P/E ratio of the S&P 500 on the Web. Assume that the expected real growth rate of GDP is 2.5% per annum. What does the stock market suggest is the S&P 500's expected rate of return these days?

Q 15.38. Use Ford's P/E ratio to value General Motors today. If Ford still has negative earnings, then use Google to value Microsoft.

Q 15.39. A firm with a P/E ratio of 10 wants to take over a firm half its size with a P/E ratio of 25. What will be the P/E ratio of the merged firm?

Q 15.40. Compute rolling TTM earnings numbers for Microsoft over the most recent four quarters.

Q 15.41. What are the main problems of comparables valuation? Give an example of each, preferably real-world or numeric examples.

Q 15.42. Is it reasonable to compare IBM's P/E ratio based on equity to the equivalent ratio at Microsoft? Is it more or less reasonable to compare IBM's P/E ratio based on total firm value to the equivalent ratio of Microsoft?

Q 15.43. Is there a problem with using a book-value-based equity measure? If so, why, and when does it matter?

Q 15.44. How could you value a biotech start-up that has no sales or earnings?

Q 15.45. What is the "quick ratio"? Is a firm more or less precarious if this ratio is high?

Q 15.46. What ingredients are in the DuPont model? What is its most important problem?