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.

Fun Youtube Video: "Incomparables"

15.1 The Marble Analogy

Similar assets' market prices can give you value estimates.

The basic idea behind valuation by comparables is simple and best understood by analogy. Got your marbles? 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 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 is non-sense.

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.

True absolute value or true relative value?

The third item means that this method only works 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 be worth $0.01 (or $100) 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 buy and sell your and equivalent marbles for $2. Your marbles are then really worth just $2 today, not $0.01 or $100 discounted. I admit that I am pushing the analogy: In a perfect market, we would all agree on the market value, anyway.

15.2 Comparables and Net Present Value

An example application of P/E comps.

Let's say you want to use the method of comparables to value Honda Corp (HMC), perhaps because you are Warren Buffett and you are interested in Honda-buying — not just a car like you or me, but the whole company. In March 2022, with access to 2021 fiscal-year end numbers, YAHOO! FINANCE (Statistics) reported the statistics in Table 15.1.

What should you do now, Warren?

(1) Find peer companies.

First, you have to find another company that you deem to be similar. What is a good comparable? For example, Toyota would seem like an obvious peer — but maybe so would Ford and/or any or all other car companies. In fact, the table shows that Rivian (RIVN) and Ferrari (RACE) are most similar in terms of valuation.

(2) Find value attribute.

Second, you have to decide on some value-relevant attribute as your benchmark. Let's say you decide — like most analysts — that the most relevant comparable attribute is earnings. The valuation ratio is then the **price-earnings ratio** (**P/E** or **P/E Ratio**).

(3) Multiply to leave P.

Third, you must assume that the financial markets value firms like Honda and its peers alike. Look at the table. Really? Based on its E/P forward ratio, Honda has expected earnings in 2022 of 48.1/7.0 ≈ 6.9 billion. Thus, each dollar of Honda's analysts' expected earnings translated into $7 of market capitalization. But if you believe that Honda should be valued like Toyota, then it should have been worth

$$\text{Honda Market Cap} \approx \underbrace{9.5}_{\substack{\text{Toyota}\\ \text{Forward P/E}}} \cdot \underbrace{\$6.9 \text{ billion}}_{\substack{\text{Honda}\\ \text{Forwrd Earnings}}} \approx \$66 \text{ billion}$$

How did it go?

Because Honda was public, we know its value was only $48.1 billion. We would have overestimated the value of Honda by 37% — not terrible but also not great. The relative error is even quicker to notice by just comparing the P/E ratios of the two companies: 7.0 (Honda) and 9.5 (Toyota). If we had chosen GM as a comparable, we would have been closer (P/E of 8.1); if we had chosen Mercedes as a peer, we would have guessed almost perfectly (6.9); and if we had chosen Volkswagen, we would have been too low (5.5). But we could have estimated far worse, too. If we had chosen Tesla (122) or Ferrari (46), we would have been wildly off. And note how even Rivian and Lucid — which had shipped under 2,000 cars together and which were not expected to become profitable for years — were worth more than Honda with its 6 million car sales per year.

			MktCap Equity	Plus Debt Minus Cash	Expected 2022 Earn	Price-Earnings Ratio Trailing	Price-Earnings Ratio Forward	(5-Year) Exp Gwth
	TSLA	Tesla	1,090.0	1,090.0	8.94	343.1	122.0	267%
	TM	Toyota	252.9	398.7	26.67	9.5	9.5	213%
	VOW3.DE	VW	113.0	230.8	20.63	5.0	5.5	55%
	GM	GM	87.9	173.9	10.80	7.8	8.1	65%
	F	Ford	85.6	185.0	8.74	29.7	9.8	18%
	MBG	Mercedes	72.3	175.2	10.46	6.3	6.9	45%
	LCID	Lucid	62.6	58.1	–1.24	–	–	?
	BMW	BMW	57.5	126.4	9.75	4.9	5.9	?
	RIVN	Rivian	57.1	55.1	–8.73	–	–	?
≫	HMC	Honda	48.1	90.9	6.83	6.4	7.0	13%
	RACE	Ferrari	47.4	48.8	1.02	48.1	46.3	277%
	STLA	Fiat-Chrysler	28.5	27.8	4.36	735.4	6.5	177%

Table 15.1: ***Automobile Manufacturers, End of 2021.*** These numbers are from YAHOO! FINANCE. The fourth numerical column is the **enterprise value**, which adds debt to and subtracts cash from the equity market value. It's more of an asset than an equity value. The trailing price-earnings ratio uses actually realized earnings; the forward price-earnings ratio uses the average consensus forecast of analysts. The expected growth is also based on these analysts' projections. The first three number columns are in billions of dollars. Prices are based from the day on which the information is retrieved (here, mid-March 2022). Because of changing stock prices, exchange-rate movements, and analysts' updates, the numbers change every day.

What is happening? Are Honda shares priced too low or Toyota shares priced too high? Is Toyota a good peer? Or are earnings not the right attribute to consider? Or maybe we need to adjust the numbers a little? Or maybe we have lost our marbles?

What's going on? Can we do better?

The Law of One Price

Conceptually, the comparables method is really not that different from the "estimated NPV" method. Both methods seek to estimate a true value in time. 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 the peer 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 similar-looking peer firms in the same business. Any other firm with equivalent expected cash flows and equivalent costs of capital qualifies as an NPV benchmark.

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

➤ Law of one price, § 1.1, Pg.2.

Finance can only do the "law of one price" thing.

Conceptually, all financial valuation methods work alike — 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 relevant* attributes should have the *same* value.
- In practice, companies with *similar relevant* attributes should have *similar* values.

Both methods work with "attributes" of firms. (NPV is an estimated statistic, which we try to map into an estimated value.)

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

- Ideally, if you knew the *true* NPV, you could also call it your comps analysis. NPV would be the metric on the X axis. Your predictive line would be a perfect diagonal, and the NPV and Comps methods would be one and the same.
- Unfortunately, in the real world, any attributes that you can use on the X axis will inevitably be less than perfect. For one, you cannot use the true NPV, simply because you rarely know it. All you usually know is an imperfect NPV *estimate*. Nevertheless, if you have enough time and excellent skill to estimate NPVs for many comps, this is a great approach. Analysts rarely do, if only because different analysts usually end up with different estimates of the NPV.
- One more readily-available attribute can be the earnings for similar firms from the same industry. (You would then work with price-earnings ratios.) Most financial websites make it easy to look up the industries into which they have classified firms and some common valuation ratios.

Earnings are the most common and most prominent comps attribute, making P/E ratios the most common method.* However, there are also many other possible 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 (or, more generally, asset value) on the y-axis, you would hope that the relationship is close and accurate.

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

For example, in graph (a) in Figure 15.2, the law of one price works very well. All firms line up nicely, like ducks in a row. This graph suggests that you have chosen good peers and 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 this line 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!

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

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 also usually the case even if you use your personal NPV estimates.)

*Mukhlynina-Nyborg report that 84% of managers also like enterprise value divided by EBITDA.

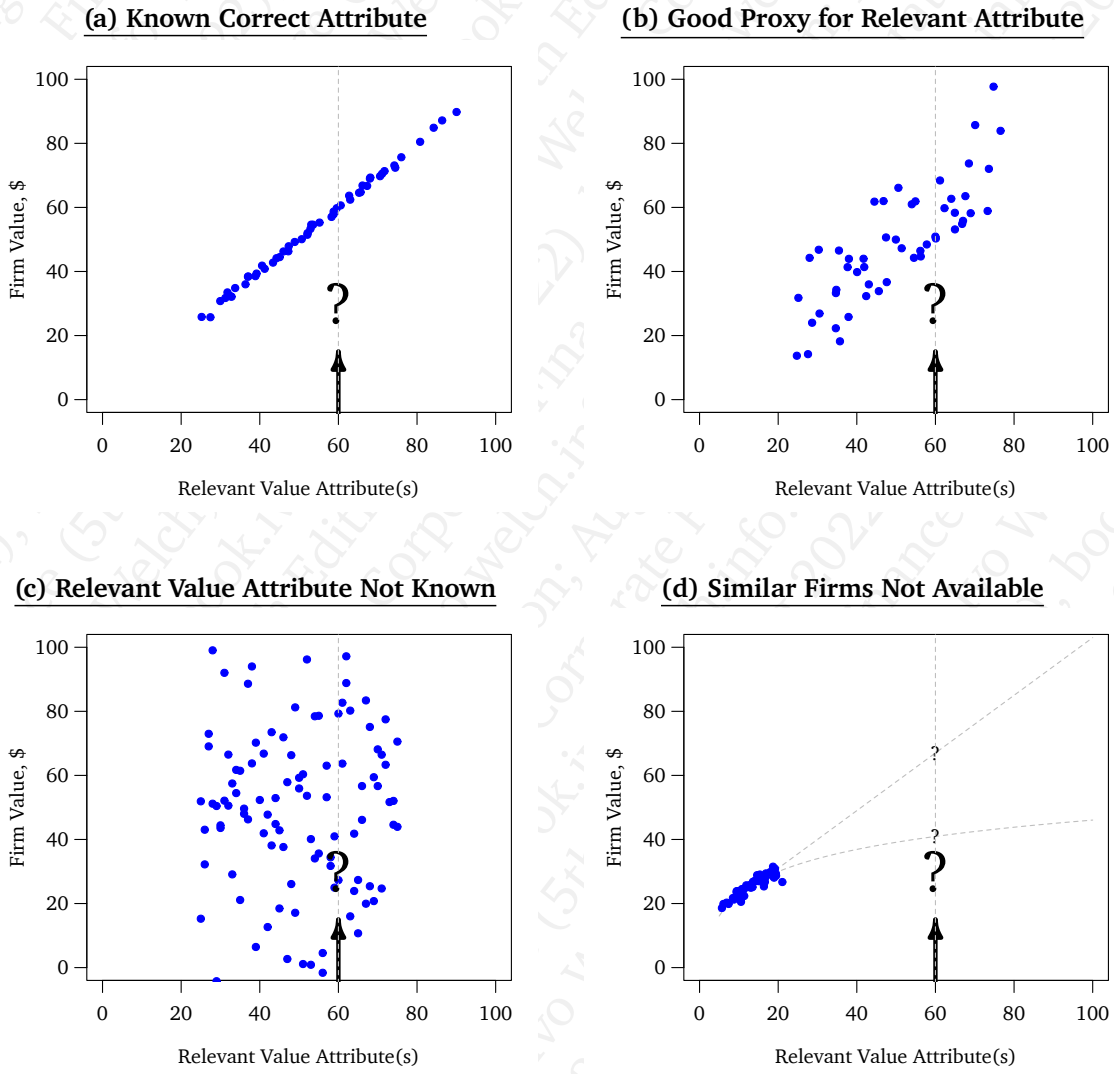

Figure 15.2: ***Conceptual Issues with Attribute-Based Valuation by Comparables.*** Your goal is to value a firm with some attribute of 60. You know the attributes and values of publicly traded comparable firms, plotted as big dots here. In graph (a), an attribute-based comparables valuation for your 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. (This may well be the situation for Bitcoin, where no good attribute measures are known to value it relative to other assets.) 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.

Although theory tells you that true NPV would make the perfect measure as in plot (a), the fact that you do not have it and instead have to estimate NPV usually renders your graph more like plot (b) even in the best of cases.

Here are examples where the pricing method works poorly.

Graphs (c) and (d) illustrate two more common problems. In (c), the attribute is basically irrelevant for valuation. It tells you nothing about the value of your firm. This kind of situation arises not only in the context of unusual "unicorn" companies, but also in the context of unusual assets like cryptocurrencies, where it is difficult to understand what "investors" ultimately value. (It ain't earnings!) In (d), even if you know the right value attribute, no comparables 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 by including different industries, so that they also find some firms with higher P/E ratios. Unfortunately, P/E ratios may mean different things for firms drawn 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.

Speculators?

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

In sum, the following are important for comparables-based valuation:

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. You can often judge how well these conditions are satisfied by looking at many publicly-traded companies in a graph. How well do they line up?

Important

A good valuation ratio (i.e., a price divided by an attribute) would show little variation in this ratio across peer firms at a given moment in time.

Sometimes, one can improve the performance of valuation ratios by making adjustments. The most common adjustment for earnings is to reduce their variability by adjusting for impending growth. We will cover these adjustments below.

Is the NPV or the Comps Method Better?

Both estimated NPV and comparables are based on similar ideas (and could even be integrated). 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 Figure 15.2-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 (in a comps estimate). 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 many times, 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 Honda Motor Co. On the one hand, if your peer alternative is an investment in Treasury bonds, the method of comparables would make little sense. Treasury-bonds with their 0-3% yields — taxed more harshly but with certain payouts — in 2022 are so completely dissimilar that looking at them is almost a non-sequitur here. You would always prefer an NPV-based estimate for Honda. On the other hand, if your peer alternative is an investment in a

seemingly very similar company with a publicly observable value, like Toyota, then the comp value may make good sense. It could approximate the true NPV better than any estimate of future expected cash flows that *an imperfect you* could come up with. If this is the case, then you could in effect free-ride 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 their many financial analysts and investors.

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:

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

Price-Earnings Definition

The price-earnings ratio is price divided by earnings.

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

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

Dividing a stock measure by a flow measure is a bit unusual, but here ok.

The price is a "stock" quantity (a snapshot at a point in time), whereas the earnings is a flow (i.e. per-unit-of-time) measure, usually annual (12-month) or quarterly (3-month) net income. 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 firm-wide 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.

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. We used the forward P/E in Table 15.1 earlier, but in Honda's case, the trailing P/E ratio would have been similar.

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

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

Why P/E Ratios Differ

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 6.4, you might say that each extra dollar of earnings translates into an extra $6.40 worth of valuation — the shares sell for 6.4 times earnings.

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

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

If you believe that your firm will not produce any future earnings, then your value estimate is just 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 foreshadowing of your higher future earnings. Your value estimate per dollar of current earnings will be a number greater than one.

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

Important

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

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:

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

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

➤ Growing perpetuities, Formula 3.1, Pg.42.

The relation between a single year's earnings number and the stream of future earnings is captured by one parameter: the expected eternal growth rate of earnings (g). (Incidentally, firms with lower costs of capital [r] can also have higher P/E ratios, but this is rarely the main channel in the cross-section and it doesn't help your intuition for the moment. Thus, we focus mostly on the earnings growth channel.)

➤ 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 have earnings of $100 next year and that its appropriate cost of capital is 15%. If this firm's income will grow by 5% per year forever, we can value it roughly as

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

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

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 tend to have lower price-earnings ratios

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.

Often hard to tell who is dying.

It's not always obvious when an industry is dying. For example, in my opinion, tobacco companies should be on the decline and as a result have low price-earnings ratios. Yet in early 2022, Altria (formerly known as Philip Morris, MO) still had a P/E ratio of 40 and analysts expected earnings growth of 5% over the next few years. The high-tech biotech firm Amgen had a higher expected earnings growth estimate of 8%, but a P/E ratio of only 20. (Both Altria and Amgen had low debt.) This situation does not match our theory, but there are also many examples that do. In Table 15.1, Tesla had a forward P/E ratio of 122, undoubtedly related to investors' faith that Elon Musk could sustain its expected growth rate of 30% per annum for a while, perhaps declining only slowly. The only way Tesla's $1 trillion could make sense would be based on the market's expectations about its future earnings growth — perhaps not just in cars but also the electrification of the entire economy.

Note also that there are two ways to increase P/E ratios: increase price or decrease earnings. Firms that are close to bankruptcy but still have positive earnings often have high P/E ratios. Their future earnings can be expected to grow relative to their distressed earnings. Fiat-Chrysler's (STLA) numbers for P/E (48!) are high not because the company's share price had performed so well, but because its earnings had performed so poorly — in fact so poorly that it is hard to see it do anything but perform better compared to its miserable (recently even negative) earnings.

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

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 [E(r)] cannot be equal to the growth rate of earnings [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. In my example, 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%.

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

➤ The Present Value of Growth Opportunities (PVGO)

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 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**).

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

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:

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

1. **The stable firm** is worth

$$\$150 = \frac{\$15}{10\%} + \mathbf{X} = \$150 + \mathbf{X}$$

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

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, given 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? Look it up.

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 15.3 into its price-earnings form. What does this say about the earnings/price yield for firms with zero 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 · 7.5% + \$500/\$1,000 · 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

Aren't P/E ratios great? So what could possibly go wrong? Plenty!

Go back to Table 15.1. Recall our attempt to value Honda shares with Toyota shares. It was "only" off by a factor of 35-40% — the ratio between Honda's P/E of 7.0 and Toyota's P/E of 9.5. What about other peers instead? Rivian, its nearest peer up in terms of market cap, had negative earnings, so it is useless. Ferrari, its nearest peer down, has a P/E ratio of 46. If we had adopted Ferrari, we would have been far off.

The task was to value Honda based on Toyota.

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 Rivian, Honda, and Ferrari were just plain wrong compared to each other. 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, and wait. (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 may not be so comparable, after all. Let's go over a few important ones.

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

➤ Getting rich "easily", § 12.4, Pg.334.

Selection of Comparison Firms

Although both Ferrari and Honda are car manufacturers, Ferrari makes high-prestige high-margin unreliable luxury cars and Honda makes low-prestige low-margin reliable mass-market cars. (Actually, Honda also makes the NSX, a supercar just like Ferrari, but the NSX is just a tiny part of Honda's repertoire.) There are almost always some such differences between firms. Are there any two products, perhaps except for pure commodities (like gold), 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.?

Honda and Ferrari

Normally, the single biggest problem with valuation by the method of comparables is finding good similar stocks. There are about 5,000 publicly traded firms to choose from in the United States alone, and multiple times this if we include foreign stocks and funds. For a benchmark for Honda, dozens are in automobile-related services. Are firms more similar if they are similar in their assets, in their business products

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

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 one of these firms qualifies. In fact, I can guarantee you that there is no company exactly like Honda. There is only one true Honda Co. (In terms of competitors, Toyota makes more than twice as many cars worldwide, three times as many cars in Japan, and five times as many cars in the United States. It thus has different market shares in different countries.)

Which alternative firm is the best comparable?

Yet, car-makers are probably as suitable a set of firms for a comps analysis as it gets. But, among all automotive peers, which one is the most similar? Depending on which firm you select, your Honda valuation could be anything between undefined (RIVN), $38 billion (VOW3.DE), and $800 billion (TSLA).

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 less on judgment than on motives. If you really wanted to make a bid to buy all of Honda, you would argue for selecting the low comparable (Volkswagen) as a starting point when you are negotiating. You would try to use this like a club (in Neolithic times). If you owned Honda, you would probably not want to insist on choosing Tesla or Ferrari as a comp (in which case the potential buyer may just walk away), but you could try for a less conspicuous "industry average" that just so happens to include them. Of course, ultimately it is not valuation arguments and sheer vociferousness that will win the day and determine the price, but the preferences of and alternatives available 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 one beautiful property: it is additive. 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 comps-based valuation have the same aggregation property? Unfortunately, no. 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. Average P/E ratios may be wrong, but analysts often average anyway. In many cases, this is because most have never even given a second thought to what they are doing. You may want to average, too, but at least you should understand what you are getting yourself into. The lack-of-averaging property has many strange implications.

You cannot calculate weighted averages.

For example, think about what would happen if Honda and Ferrari were to announce a merger with an explicit charter not to interfere in each other's business. Looking back at Table 15.1, the combined earnings would be $6.83 + $1.02 = $7.85 billion for 2022. The combined market cap would be $48.1 + $47.1 = $95.5 billion. Ergo, the P/E ratio for Honda-Ferrari will be about 12.2. This is far from the value-weighted average P/E ratio of the two companies:

$$\underbrace{\frac{\$48.1}{\$48.1+\$47.4}}_{w_{\text{Honda}}} \cdot \underbrace{7.0}_{(P/E)_{\text{Honda}}} + \underbrace{\frac{\$47.4}{\$48.1+\$47.4}}_{w_{\text{Ferrari}}} \cdot \underbrace{46.3}_{(P/E)_{\text{Ferrari}}} \approx 26.5$$

If you assumed that the average or combined firm had this "average" 26.5 P/E ratio, instead of the correct 12.2 P/E ratio, you would have misestimated the value of the

combined company by "only" more than double. Mergers can change P/E ratios even if they do not create value.

Important

Unlike market betas and costs of capital, price-earnings ratios cannot be value-weighted and averaged. Thus, P/E-implied values are not additive.

For example, if you want to value an existing conglomerate firm, should you use "average" P/E ratios from multiple comparable firms, one for each subsidiary and business line, or try to find one conglomerate that is a peer on all segments? Naturally, even though I have just explained that you cannot aggregate and disaggregate P/E ratios, you will still be tempted to adopt not the P/E ratio of any one single peer but those of a few peers. And like anybody else, you will be tempted to "split the difference." Yes, you can only compare full peer 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.

There is an even more common problem:

Averaging P/E ratios is adhoc.

Important

Because they cannot be averaged, industry or other average P/E ratios are not theoretically meaningful. However, the alternative (of using just a single comp) is practically often worse.

The 1/X Domain Problem

There is an even worse problem.

Important

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

P/E ratios are an example of this general rule, 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."

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

Recall the forward ratios for car makers:

Ignoring negatives in averages?

TSLA	TM	VOW	GM	F	MBG	LCID	BMW	RIVN	RACE	STLA
122	9.5	5.5	8.1	9.8	6.9	[–50]	5.9	[–7]	46.3	6.5

Like other analysts, we will try to work with an average "car industry" P/E ratio. In this example, it would be about 15, twice as high as the correct P/E ratio for Honda 7. Ouch! This is mostly because of Tesla and Ferrari. Maybe we should ignore them. (What gives us the right to throw out the highest P/E ratios? And won't this bias our numbers? Of course, it will!) Let's thrown them out anyway and recalculate. Now we get an industry average P/E ratio of –0.5. Ouch, ouch! OK, maybe we should ignore the negative P/E ratios, too. In the industry, negative P/E ratios are never quoted, so this is standard practice. If we do so, we now get a P/E ratio of 7.5. Better. (But what gives us the right to throw out the lowest P/E ratios? And won't this bias our numbers? Of course, it will!)

Sensitivity can lead to crazy results.

But let's say we just learned that instead of losing \$1.24 billion, Lucid managed to earn +\$0.0124 billion — small typo on their press release, not a huge deal of money in an industry worth about \$1.5 trillion. (Or they managed to find a single fan buyer willing to pay a lot of money for the next 1,000 cars.) In this case, Lucid's P/E ratio would be \$62.6/0.0124 ≈ 5,000 — and now we would include it (again). Ouch, ouch, ouch!

What do minor changes in forward earnings do?

Whatever we keep or throw out will be arbitrary. Whatever we do with firms that have small earnings will have a very large effect on the industry P/E ratio.

➤ 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 ad hoc procedures that try to deal with it.

1. **Ignore nonpositive earnings firms:** As noted, the most common analysts' practice is to drop 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 Rivian at \$48 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 our automobile case, the median P/E was MBG's 6.9. It was not affected by the *weirdos*. The drawback is that the median ignores many specific P/E quantities — information that should be quite relevant. (What if we tried to value Toyota with its true P/E ratio of 9.5 against a median of P/E ratio of 6.9?)

3. **Average E/P yields inverted:** The reciprocal of P/E is the **earnings-price yield**.

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

   If the earnings are positive, then a higher price-earnings ratio implies a lower earnings/price yield, and vice-versa. The earnings yield is guaranteed to have a positive denominator. which avoids the 1/X domain problem. It is always meaningful even if earnings are tiny or negative — you do not need to treat them in a special way. Unfortunately, although this "first-invert" method guarantees

that this "minimum sanity" condition holds, it offers no other guarantees such as better accuracy. (For this matter, drawing random numbers between 120 and 130 would also be guaranteed to be positive.)

For our car companies:

TSLA	TM	VOW	GM	F	MBG	LCID	RIVN	RACE	BMW	STLA
0.8%	10.5%	18.2%	12.3%	10.2%	14.5%	–2.0%	–14.3%	2.2%	17%	15.4%

The mean E/P yield is 7.7%. Inverting back gives an industry P/E ratio of 13.

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 $98 billion. The market cap total is about $2,003 billion, for a P/E "average" of about 20. The reason why this is so large is that this method is akin to value-weighting — and Tesla's marketcap is very large indeed. (There could be a hundred small firms with a few million dollars in value in this average and it wouldn't matter here. It would in the earlier methods.)

These methods can *sometimes* provide reasonable P/E industry estimates — whatever "reasonable" reasonably means.

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 non-sensible 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 the aggregated market value by the aggregated 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 many comparables, not an exact number.

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?

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 (IVV) as 16.4 and that of its iShares Russell 2000 ETF as 19.1. The Russell 2000 includes many mid-market 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).*

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 a small mechanical problem, too: timing. Only about half of all publicly-traded firms have a December fiscal year. (Financial statements have to be prepared and are thus usually released 2-3 months later.) For example, while Rivian and Ferrari close annual statements in December, Honda and Toyota close them in March. When I reported 2021 financials in Table 15.1, I did *not* report Honda's numbers from its last annual statement in March 2021. Instead, I adjusted Honda's numbers "as if they had been reported in December 2021." Choosing an equivalent December price in the P-E ratio is easy — just use whatever the current price was in December. The same would apply to all "stock" numbers on the balance-sheet, like assets or cash. Stock numbers should remain whatever was reported at that time. This is sometimes noted with the suffix **mrq** (**most recent quarter**).

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

However, using the most recent numbers would be wrong for "flow" numbers, like those reported on the income statement or cashflow statement. Instead of using the stock, we have to use the **trailing twelve months** (**TTM**) adjustment. Table 15.3 shows how this was done for Honda. Instead of using Honda's last annual net income of $5,944 from March 2021, we added up the last four quarterly income numbers ending in December 2021 to obtain $6,745. (The same result obtains if we start with the last annual numbers, and add later quarters while subtracting earlier ones: $5,944 – (–$750 + $2,005) – ($2,268 + $1,484) – ($2,738 + $1,567) = $6,745.)

Managers can make it difficult to detect skeletons.

Watch out, though: Managers have many tricks to hide skeletons. For example, firms can switch fiscal year ends to make consecutive-year comparisons more difficult. Also, 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

Statement Type	Relevant Period Ends	Fiscal Year	Qtr	Quarterly Earnings	Trailing 4 Quarters	Annual Report
Annual	2020/03/31	2019	Q4	–$230	$4,235	$4,235
Quarterly	2020/06/30	2020	Q1	–$750	$1,887	n/a
Quarterly	2020/09/30	2020	Q2	$2,268	$2,340	n/a
Quarterly	2020/12/31	2020	Q3	$2,738	$4,025	n/a
Annual	2021/03/31	2020	Q4	$1,689	$5,944	$5,944
Quarterly	2021/06/30	2021	Q1	$2,005	$8,699	n/a
Quarterly	2021/09/30	2021	Q2	$1,484	$7,916	n/a
Quarterly	2021/12/31	2021	Q3	$1,567	$6,745	n/a

Table 15.3: *Honda Motor Co's (HMC) earnings by quarter.* Trailing Four Quarters is more commonly called "Trailing Twelve Months" (TTM). **Source:** Compustat, quoted in USD

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 of the two firms' financials — again, making it more difficult to benchmark accounting performance. Yet another complication is that new incoming CEOs like to write down all sorts of earlier bad investments, so that their "own" future performance will look better later.) Always interpret numbers skeptically with appropriate caution.

Q 15.13. Go to YAHOO!FINANCE and rework the calculations to create comparable P/E ratios for the most recent trailing quarter for the four computer tech giants, META, MSFT, GOOGL, and AAPL.

Debt Adjustments for P/E Ratios

Does leverage influence 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?

Fortunately, both price and earnings are changed by leverage.

First, note that both numerator and denominator in a P/E ratio respond to a debt-for-equity swap and in the same direction. If the same firm with the same assets has more debt, then both its market-value of equity (price) and its post-interest earnings become lower. Ergo, on a first-order basis, P/E is not a "stupid" ratio. In contrast, the equity-price-to-employees ratio is pretty stupid, because only the value of equity declines with more debt. In this case, the same firm financed not with equity but with debt mechanically has to have a lower ratio.

Unfortunately, price and earnings do not change proportionately, so P/E ratios can change.

However, on a second-order basis, P/E ratios can change, because the price of equity and its earnings do not shrink by the same fraction. This can have consequences. If the same 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 peer firm (that does everything just like your own firm) no longer match so well when it has a different capital structure? It turns out that debt indeed changes the P/E ratio, but not necessarily either positively or negatively. Roughly speaking:

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

You will get to see these observations at work 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 at all. 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 be treated as if it became 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 be treated as if they became equity payments and would 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, debt adjustments rarely change price-earnings relative value inferences dramatically, except when you want to compare extremely highly-levered firms (like banks or financially distressed firms) with other companies.

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

15.5 An Empirical Market Snapshot (Early 2022)

Does not apply on other days!

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 2022. However, please do not believe the pattern here generalizes to the situation on other dates. The main point I want you to understand is how error-prone P/E ratios can be.

Statistics for Some Selected Firms, Early 2022

Ticker	Firm	Frwrd P/E	Ticker	Firm	Frwrd P/E	Ticker	Firm	Frwrd P/E
GS	Goldman Sachs	9	INTC	Intel	14	HD	Home Depot	24
WBA	Walgreens	9	JNJ	Johnson & Johnson	16	KO	Coca-Cola	24
DOW	Dow	9	CAT	Caterpillar	16	MCD	McDonald's	27
MRK	Merck	10	CSCO	Cisco	16	PG	Procter & Gamble	28
VZ	Verizon	10	AXP	American Express	17	V	Visa	30
AMGN	Amgen	12	MMM	3M	17	AAPL	Apple	32
CVX	Chevron	12	BA	Boeing	20	DIS	Walt Disney	34
IBM	IBM	12	WMT	Walmart	21	MSFT	Microsoft	37
JPM	JPMorganChase	13	HON	Honeywell	23	NKE	Nike	48
TRV	Travelers	13	UNH	UnitedHealth	23	CRM	Salesforce.Com	51

Table 15.4: ***Dow-Jones 30 Stocks Forward P/E Ratios as of December 2021.*** Ratios are starkly rounded to reduce the illusion of accuracy.

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

Table 15.4 presents the price-earnings ratios for the Dow Jones 30 components in December 2021. You can readily download data to create similar tables from YAHOO!FINANCE. Stare at this table for a while. I find it humbling to look at the numbers. I can spin stories ex-post why one is high and another is low, but if I had had to do this before seeing the table, it would have been a stab in the dark. Why is Nike (with a 48 P/E ratio) still high-growth while Merck (with a 10 P/E ratio) is not? Beats me.

Earnings, Prices, and Growth, Early 2022

The general relationship between earnings, earnings-growth, 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 2021? Let's try to work with plots akin to that in Figure 15.2, with the earnings attribute on the X axis and the price on the Y axis. Alas, Figure 15.5 shows that this does not get us very far. The reason is that most of the largest 1000 firms cluster around $1 to $20 billion in earnings and $0 to $100 billion in market capitalization — and then there are three tech giants MSFT, GOOGL, and AAPL, as well as META and AMZN, which are practically off the chart. We need to scale this better — but logarithms won't work because earnings can be negative.

The conceptual figures in real life.

Therefore let's go with a better figure. Figure 15.6 plots firms by their past three-year growth rate on the X-axis and their earnings-price ratio on the Y-axis. If the theory holds, faster-growing firms should have higher P/E ratios, i.e., lower E/P earnings yields. The relationship should be downward-sloping. Firms with negative growth rates of earnings are difficult to interpret. But even for firms with positive earnings growth, the relationship between earnings growth and price-earnings yields is not very strong. The average E/P yield was about 5%, a P/E ratio of about 20, regardless of growth. And there were plenty of firms with low growth rates of earnings

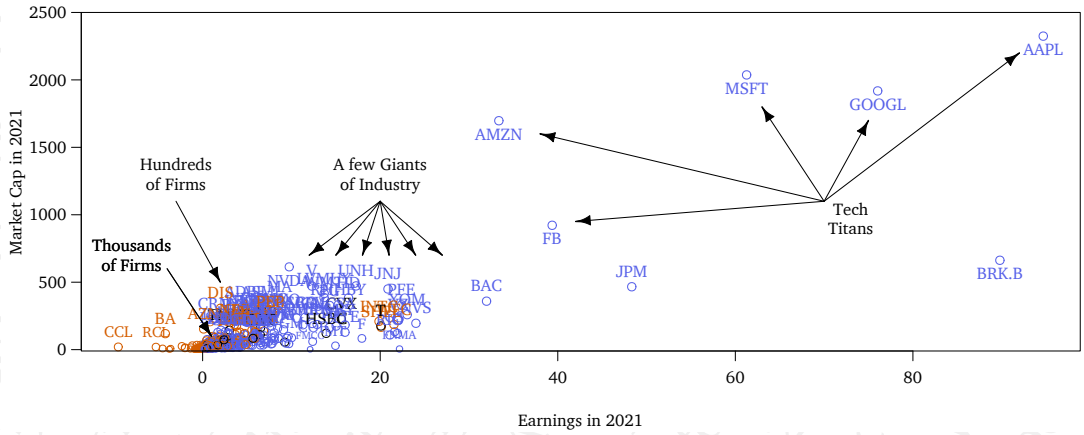

Figure 15.5: ***Earnings (before extraordinary items) and Market Capitalization in 2021.*** This graph plots the 1,000 largest firms by equity market capitalization. Unfortunately, the graph is dominated by fewer than a dozen firms or so — mostly some tech giants, Berkshire Hathaway, and JP Morgan / Bank of America. Red dots mean that the firms shrank in market cap from 2018-2021; blue dots mean that market cap increased. Only firms with positive earnings in 2018 are included (which excludes, e.g., TSLA), because I needed to compute a growth rate of earnings.

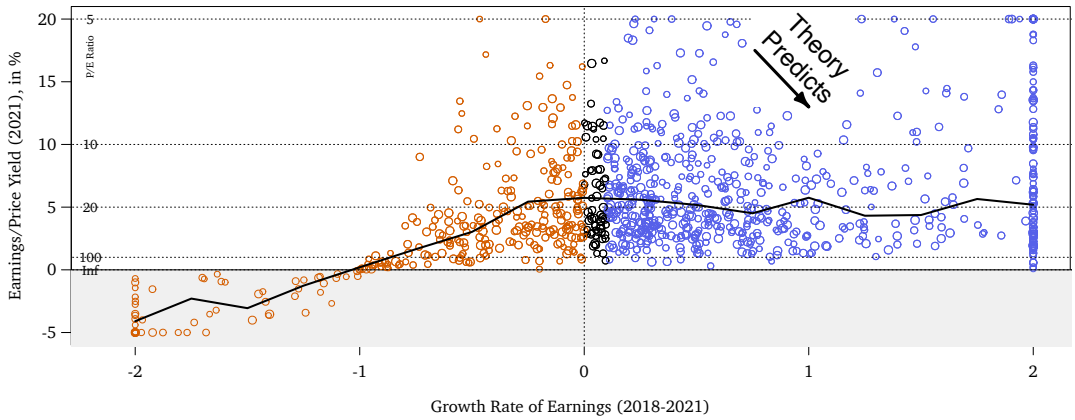

Figure 15.6: ***Three-Year Growth Rate of Earnings versus Earnings Yield, 2021.*** Each dot is a stock. Growth rate of earnings was winsorized at –200% and +200% (winsorizing means outliers were truncated at these values). Earnings-price ratios on the Y-axis were winsorized at –5% and +20%. Red dots mean that the firms shrunk in market cap from 2018-2021; blue dots mean that firms' market caps increased. The size of the circle indicates the marketcap of the firm at the outset (i.e., in 2018). The plot excludes all firms with negative earnings in 2018. Because earnings in 2021 can be negative, the earnings growth rate can be below –100%.

and high P/E ratios and vice-versa. The variations in P/E ratios for the same growth rates are so tremendous that they swamp any mean patterns. Look at any vertical slice for a normal growth rate of earnings. Now look at all the Y values on this slice. Keep in mind that a 5% earnings yield means "only" twice the P/E ratio of a 10% earnings yield. And it is not uncommon to see firms with similar earnings growth rates (on the same 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 "double" among friends?

The lack of fit in this plot is not unusual. Although the years from 2018 to 2021 were clearly strange, with countries locked down by Covid, even in other years, graphs equivalent to Figure 15.6 rarely fit better. If we limited the comparison to industries, we could improve the fit a little but not by much. For example, even only with car makers, Tesla, Ferrari, Rivian, and Lucid would stick out like sore thumbs.

What is a price disagreement of "factor 50" among friends?

Plots like this nearly always fit badly.

Why do these price/earnings plots fit so poorly? Our earnings growth projections may not be good enough stand-ins for firms' true infinite earnings growth. This would render the theory practically useless. Of course, the theory itself could be wrong, too. Think about Bitcoin (BTC). Bitcoin's earnings are zero and will always be zero. Yet, speculators were willing to pay over $45,000 for a Bitcoin number-sequence on December 31, 2021. Why? Beats me. Bitcoin is not the only asset that I do not understand. Investors' love moves in mysterious ways. In 2020, Robinhood investors loved a stock called "India Globalization Capital" (IGC). IGC's earnings have always been negative and no serious analyst seems to follow IGC. It sells construction commodities (think doors and marble) and rents out construction equipment (think cranes). However, around 2017, IGC also added a second business — Marijuana (under the "Holi Hemp" brand). As many Robinhooders invested in IGC as invested in J.P. Morgan Chase (JPM). This makes little sense to me. Can you short IGC to try to profit from this strange preference? Recall what I wrote in Section 12.3: If enough Robinhooders love IGC today, what stops even more of them from loving IGC even more next year? It is very difficult to arbitrage "love." (If you do short IGC, make sure that your exposure remains small.

What the heck??

U2

Managers and analysts often do not realize how noisy their P/E 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.

(Sarcasm warning)

Incidentally, some hedge funds have tried to exploit the differences in Figure 15.5 for **pair trading**, where they go long on one stock with a low P/E ratio and short another "similar" stock (often in the same industry) with a high P/E ratio. Such strategies have occasionally been successful, but more often than not they earn just average returns. These investment strategies fail because there is no strong force that tends to push firms with similar earnings growth towards similar P/E ratios. Any reversion tendency toward a common P/E mean is so slow that it is difficult to confirm empirically.

Pair(s) trading is really the same thing.

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. Valuation by comparables is bound to remain 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 claimed theory was harder than real life? It ain't so.

C'est la vie.

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.

Repeated Warning: The cross-sectional relation between earnings growth and earnings/price yields is not stable over the business cycle. Therefore, if you want to use figures like this in order to value firms, you must first plot the *prevailing* relation between earnings growth and earnings yields (the inverse of P/E ratios) in *your* time. You can only use Figure 15.5 in March of 2022. 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. The earnings growth in economic expansions is unsustainable. Eventually, every boom must end. In contrast, during recessions, earnings growth can be negative. Yet P/E ratios can remain relatively too high, because investors expect that earnings will eventually grow again. For example, at the end of the first dot.com bubble in early 2001, corporate earnings had grown 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, for a year-to-year earnings growth rate of –40%. Investors would not have expected this malaise to last forever, either. If you had relied on the growing perpetuity formulas, firms would have appeared to be overvalued.

15.6 Understanding Historical S&P 500 Price-Earnings Ratios

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

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 index as a stand-in for the stock market. The upper plot in Figure 15.7 graphs the P/E ratio of the S&P 500. You should immediately notice the spikes in 2000-1, 2008, and 2020, 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. Does the theory perhaps fit better in the time-series? Not really — the dividend yield did not show the same spike in the Great Recession of 2008-9, but did show the same spikes in 2000 and 2020.

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

How can you interpret P/E spikes above 40 in time? Let's recap our theory,

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

You can rearrange the formula

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

where I have named the ratio "Expected Earnings Next Year/Price Now" the "earnings yield." Of course, a higher price-earnings ratio implies a lower earnings yield for assets with positive earnings. Therefore, the formula says that if your P/E ratio goes up, your expected rate of return goes down, holding the growth rate of earnings constant. Now let's put ourselves into investors' shoes at the turn of the millennium:

1. **The earnings yield:** A P/E ratio of 40 is an earnings yield of 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?

   Over the previous decades, the real (post-inflation) earnings growth rate was about 2%. In 2000, over the one most recent decade, earnings had grown by

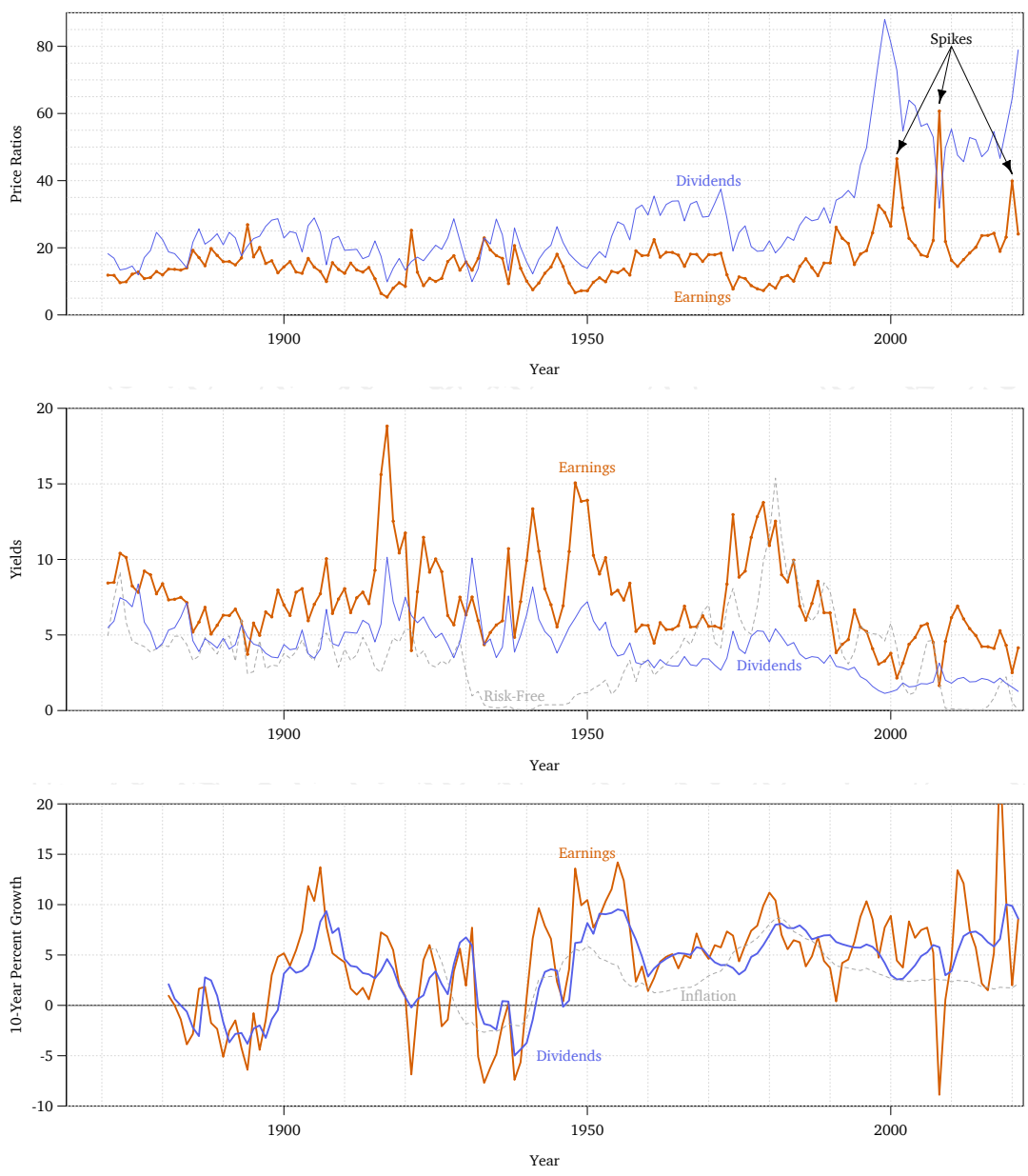

Figure 15.7: ***The Price Ratios, Yields, and Growth Rates of the S&P 500.*** The upper plot shows the history of the price-earnings ratio and the price-dividend ratio for the S&P 500. The P/E ratio peaked first in 2001 and again in 2008 and 2020. (In hindsight, we know that the Great Recession of 2008-9 did not turn into another Great Depression and Covid did not turn into the equivalent of the Medieval Plague.) The middle plot for earnings-yields and dividend-yields is "just" the inverse and also plots the prevailing short-term risk-free interest rate. The lower plot shows 10-year growth rates. (The data are available from Amit Goyal's website. The early data is from Robert Shiller's book Irrational Exuberance.)

5-8% per annum (depending on what exact moment you choose) and dividends by about 3-5% per annum, but inflation had been coming down. Thus, in the lower-inflation environment of 2000, a predicted nominal earnings growth rate of about 5% would have been on the high side. This would be enormous. The highest *long-run* real growth rate of earnings (at the start of the Industrial Revolution) was no more than 4% per year. Add prevailing 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 another industrial revolution — and not just for a while but forever. In fact, this was exactly what analysts at the time were touting to hapless investors: It was the *new economy*, where old rules would no longer apply and everyone could easily get rich.

With this optimistic assessment, you should have expected a rate of return on the stock market of no more than about

$$\begin{aligned}\text{Expected Rate of Return} &= \text{Eternal Earnings Growth} + \text{Earnings Yield}\\ &= \quad 2.5\% + 6\% = 8.5\%\end{aligned}$$

With a prevailing Treasury bond yield of 5%, this would have been an equity premium estimate of about 3.5% — high but in line with our earlier equity-premium estimate in Chapter 9. Switch gears now: What did investors seem to believe in late 1999? Stock prices had just soared with returns of above 25% per annum over several years in the late 1990s. When surveyed in late 1999, investors claimed expected rates of return of 15-20% or more — equity premia of 10-15% per year. (I wonder what most Bitcoin investors are expecting now.) Simply put, this optimism did not jive with reality.

Due credit goes to Bob Shiller!

This argument was most forcefully advanced by Professor Robert Shiller's best-selling book, *Irrational Exuberance*. It was published just before the stock market peaked in 2000 — good timing! It transformed Bob into an instant market guru and did not hurt when he was considered for a Nobel Prize a few years later, which he won. (Bob also called the housing crash of 2007 years in advance. Two correct predictions made him a veritable guru!) But don't get smitten: 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 declines in the years between that had not come true.

😊He predicted 10 out of the last 3 bear markets!

Q 15.15. Is PVGO usually higher or lower for firms with high P/E ratios? What should it be if E is negative?

Q 15.16. Is the relation between earnings multiples and earnings growth rates usually positive or negative? Is it always so? If not, why not?

Q 15.17. 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?

15.7 Other Financial Ratios

The P/E ratio is not the only commonly used financial ratio. This is not a surprise, because ratios are so 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). Some other ratios help inform you about the economics of the firm, even if they cannot advise you directly about appropriate value of the firm. (And other ratios are simply nonsense.) Let's look at some more reasonable ones.

Let's look at financial ratios.

Valuation Ratios

A **valuation ratio** has price in its numerator and some measurable attribute in its denominator. Only the user's imagination limits the attributes that can be (ab-)used. 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 estimate its value. The P/E ratio is often the best valuation ratio, although you should understand by now that it is not a magic bullet (and perhaps not even a paintball). Other valuation ratios work analogously.

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

➤ Earnings-Based Multiples

Your ultimate goal is to find a measure that is proportional to value and has as little noise as possible. Sometimes this means that a different form of earnings works better. 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 firms appear to be as similar as possible to each other and 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.

You can use different flavors of earnings.

➤ EBITDA Anecdote, Pg.432.

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 earnings-ratios are therefore more common than cash-flow ratios.

You can use cash flows, although they are spikier.

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 15.6. 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 — it divides them rather than adds them. This means, e.g., if the growth rate of earnings is very small or negative, the PEG ratio pretty much produces nonsense.

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

➤ r = g + E/P, Formula 15.6, Pg.24.

➤ **Book-Value Based Multiples**

			Equity	Enterprise	MV Equity Divided By Book Value	MV Equity Divided By Sales	Enterprise Value Dvdd By Sales	Enterprise Value Dvdd By EBITDA
	TSLA	Tesla	1,090.0	1,090.0	40.35	25.63	61.27	305.48
≫	TM	Toyota	252.9	398.7	1.20	0.96	0.05	0.32
	VOW3.DE	VW	113.0	230.8	0.64	0.35	3.63	17.24
	GM	GM	87.9	173.9	1.62	0.66	5.17	32.20
	F	Ford	85.6	185.0	2.34	0.62	4.91	12.79
	MBG	Mercedes	72.3	175.2	0.98	0.43	4.97	30.89
	LCID	Lucid	62.6	58.1	n/a	n/a	2,200.00	–57.6
	BMW	BMW	57.5	126.4	0.81	0.52	4.45	27.18
≫	RIVN	Rivian	57.1	55.1	n/a	45.91	55,140.00	–22.28
≫	HMC	Honda	48.1	90.9	0.59	0.39	0.02	0.21
≫	RACE	Ferrari	47.4	48.8	20.44	10.15	41.68	130.21
	STLA	Fiat-Chrysler	28.5	27.8	0.92	0.26	0.97	8.56

Table 15.8: ***Other Valuation Ratios.*** The numbers here are from early March 2022 from YAHOO!FINANCE ("Statistics"). Note that while they report values with negative earnings as *n/a*, Yahoo mindlessly reports negative ratios for Enterprise value divided by EBITDA, although these ratios suffer from the same 1/X problem. We will often focus on the four firms with ≫, Honda and these three peers.

Accounting is better at flow measures than stock measures.

➤ Warning about BV stock numbers, § 14.7, Pg.445.

Earnings and cash-flow valuation ratios divide a market-based snapshot value by an accounting flow (either from the income or cash flow statements). Some popular ratios instead relate to or divide by an attribute from the balance sheet, even though many balance sheet figures are notoriously unreliable. Thus, if you choose a stock number from the balance sheet as your valuation attribute, you need to be especially suspicious.

The book value of equity is particularly tempting and problematic.

The most tempting ratio is the **price-to-book** (P/B) ratio, where B is usually the **book value of equity** (BV of equity, or BVE). After all, presumably this is the accountants' attempt to value the firm based on its assets. Have we finally found the great attribute for explaining the market value of equity (MVE) that we so badly desire? Unfortunately, the answer is no. As already explained, the book value is better viewed as a placeholder.

➤ What to trust on the balance sheet, § 14.7, Pg.445.

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

For older firms in particular, book equity values are often just a fraction of the true equity market values. 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.

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

The fact that the book value of equity can also be non-sensibly negative, despite limited liability, furthermore means that if the book value of equity appears in the denominator of a valuation ratio, it can cause a 1/X domain problem. Recall from Section 15.4: ratios in which the denominator can turn negative make no sense.

1/X problem, too.

All these theoretical problems aside, maybe some ratio works well in practice, anyway. Recall that a ratio (possibly with adjustments) is good and reliable when it is about the same for every firm. Table 15.8 reproduces a prominent table on YAHOO! FINANCE. It shows that the P/B ratio does not do all that well: Honda's ratio was 0.59, Toyota's was about twice that of Honda's, Rivian's was meaningless, and Ferrari's was seemingly from another planet.

How does P/B work for Honda?

➤ Sales-Based Multiples

Many biotech firms have neither earnings nor sales. What can you use then? How can you value a firm that does not have positive earnings or even positive book equity? Or a firm in an industry in which there are not many peers with positive earnings and book equity?

Double yikes!

If the firm has negative earnings but positive sales, analysts often resort to a **price/sales** (P/S) ratio. Because gross sales are never negative, the P/S ratio largely avoids the 1/X domain problem. (Net sales are almost always positive.) The idea is that firms with higher sales should be worth more. This ratio also has another advantage: sales may be more difficult to manipulate than earnings, so this ratio 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.

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

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 (AMZN) sold merchandise at a loss. Consequently, the more products Amazon sold, the more money it lost — and the more valuable it appeared to be. This was perplexing, but ultimately a great strategy because it allowed Amazon to scale up quickly. Amazon won out. Many other firms following the same strategy went bankrupt.

Firms losing money can have great sales.

Table 15.8 shows how the price/sales ratio would have fared for the car companies from Table 15.1. The ratio does not do very well: Honda and Toyota were off by more than a factor of two (0.39 vs 0.96). The ratios for Rivian and Ferrari were hugely far off at 46 and 10.

How does P/S work for Honda?

➤ Enterprise Ratios

A price-earnings ratio makes sense, because both the price of equity and earnings apply to equity. Earnings have interest subtracted out and book-equity does not include debt. A debt-for-equity swap reduces both the amount of equity and the amount of earnings. This is a first-order effect. (The ratio can change because the changes are not necessarily proportional, but these are second-order effects.)

Good ratios don't mix equity-based and asset-based numbers.

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

As mentioned earlier, such minimal sanity is not always the case for many other common valuation ratios. Many 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 quantities like sales, employees, scientists, or patents are firm-wide and independent of financing. The amount of equity is not. Thus, the sales-based equity multiple we just looked at was non-sense — even if such a ratio appears prominently on YAHOO!FINANCE. For example, Ferrari earned its sales with $49 billion of enterprise value, while Honda earned its sales with $91 billion. For ratios that are firm-wide, we should use assets or enterprise ratios in the numerator.

Firms with more debt have lower equity and lower earnings.

Unfortunately, Table 15.8 shows that this enterprise sales ratio does not solve the problem that car manufacturers had widely diverse ratios. In fact, the opposite may well be the case. Rivian and Ferrari had tiny sales compared to Honda, and much less debt, yet they had much higher enterprise values.

☺ The hamster's dead, but the wheel's still spinning. YAHOO!FINANCE seems to have deteriorated over the last decade, but Bloomberg is not free for students.

YAHOO!FINANCE also showed an *Enterprise Value to EBITDA ratio*. I have no idea why analysts would look at this number. EBITDA can be negative. (Then again, as far as I can tell, there is really no human at the end of the line at YAHOO!FINANCE whom I could ask, "What were you thinking?"

➤ Last-Resort Valuation Ratios

Stupid valuation attempts.

There are valuable firms that have no sales, negative book-value of equity, and negative earnings. This is the case for many research firms. They are primarily a bunch of real options. Not surprisingly, the standard financials (earnings, sales, etc.) seem irrelevant to the eventual long-term profitability of the firm in such cases. More often, the value is based on a technology bet. Will the firm's cancer cure work? Will it solve global warming?

➤ Real options, § 13.7, Pg.392.

Last-resort ratios.

In this case, analysts sometimes use "last-resort" ratios. For example, they may use the number of employees or scientists or patents as a rough measure of progress. They would never use such ratios for carmakers, but we will show how this doesn't work well in our case, either. We will look at just Honda, Toyota (intuitively the most similar peer firm), and the two car companies closer in marketcap (but not operations) to Honda, which are Rivian (RIV) and Ferrari (RACE). Honing in on these four firms shows how numbers can be quite different for large and small firms, for established firms and high-tech startups, and firms with different customer clienteles.

Value per employee

The *price-to-employees ratio* (or better, the *enterprise-value-to-employees ratio* or *asset-value-to employees* ratio) assumes that the employees at the comparable firm are as productive as the employees in the company to be valued.

	Honda	Toyota	Ferrari	Rivian
Employees	211,000	366,000	4,500	3,200
Equity (in b-$)	48.1	252.9	47.4	57.1
Enterprise Value (in b-$)	90.9	398.7	48.8	55.1
Equity-V/Employee	$228 k	$691 k	$10,500 k	$17,840 k
Enterprise-V/Employee	$431 k	$1,089 k	$10,844 k	$17,219 k

Apparently, this ratio does not cure the problem of large variability in the valuation ratio. Another problem is that this ratio is not manipulation-resistant. If firms know

that they will be evaluated by this ratio, then it can induce them to hire the cheapest employees *even if they are incompetent and useless* in order to increase their valuations. After all, firms with more employees are presumably worth more. (It's like "teaching to the test.")

Value per scientist.

The *price-to-scientists ratio* is similar to the price-to-employees ratio, except for the fact that the number of scientists is more difficult to obtain. And of course, engineers and scientists are also not all alike. (Elon Musk is not an average and replaceable person.)

Value per patent.

The *price-to-patent 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.

😉 Don't trust ratios and trees — they are pretty shady.

None of these ratios is particularly confidence-inspiring, either theoretically or empirically. For R&D intensive 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.

Q 15.18. When would you use a price/sales ratio? Why?

Q 15.19. Why are price/sales ratios problematic?

Q 15.20. In March 2022, YAHOO!FINANCE reported the following statistics for December 2021:

	KO	KDP	PEP	Nestlé (NSRGY)
Market Cap (in b-$)	$262	$54	$224	
Employees	80,000	27,000	309,000	273,000
Revenue (in b-$)	$38,655	$12,683	$79,474	$84,470
EBITDA (in b-$)	$15,474	$4,128	$14,899	$17,927
Net Income (in b-$)	$9.771	$2,146	$7,618	$16,905

KO is Coca-Cola, KDP is Keurig-Dr.Pepper, PEP is Pepsico. Nestlé (making ice teas among other products) was not a traded company for a long time, but rather a Swiss "anonymous society." What do you think Nestle should be worth?

Q 15.21. In Dec 2021, YAHOO!FINANCE reported the following information:

			Operating Cash Flow				
Firm	**Cash**	**Sales**	**Plain**	**Levered**	**Debt**	**D/E**	**MV of Equity**
AAPL	$63.9	$378	$112.2	$80.2	$123	171	$2.53T
GOOGL	$139.7	$258	$91.7	$49.5	$29	11	$1.72T
MSFT	$125.4	$185	$83.9	$46.5	$80	50	$2.10T
FB	$48.0	$118	$7.7	$28.8	$15	12	$0.51T

"Levered" is minus debt and interest payments. What number makes least sense here to you? Why? At this moment in time, what would have been the most consistent (sensible) ratio for valuing these companies relative to one another?

Non-Valuation and Diagnostic Financial Ratios

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

Not all financial 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 of these ratios are reasonably similar only *within* an industry, but not *across* industries. They also vary often over the business cycle. Thus, they should only be compared to similar firms at the same time.

First, let's start with some background from the four car companies' Dec 2021 financial statements (in billions of U.S. dollars):[†]

		Book Value				Market Value	
Ticker	Name	Assets	Liabilities	Fin'l Debt	Equity	Equity	Assets
HMC	Honda	193.3	106.1	65.9	93.1	49.1	157.5
TM	Toyota	552.6	328.0	218.2	227.9	256.1	592.0
RACE	Ferrari	7.8	5.3	3.0	2.6	47.6	52.9
RIVN	Rivian	22.3	2.8	1.4	19.5	93.3	96.1

Table 15.9: ***Balance Sheet Values, December 2021.*** Book values are from published financials; market values are calculated from the number of shares outstanding and the prevailing stock price on December 31, 2021. The market value of assets is the book value of assets minus the book value of equity plus the market value of equity. Financial Debt includes long-term debt and debt in current liabilities.

Book value or market value?

Table 15.9 shows that Honda is one of the rare companies with higher book value ($93 billion) than market value ($49 billion). Analysts calculate many ratios based on book values rather than market values. This is because the market-value numbers are not on the balance sheet and have to be computed from prevailing prices. Thus, laziness contributes as much to the wide use of the book value of equity as ignorance does. Sometimes, analysts use not just common stock equity, but all equity (including preferred equity). As for debt, everyone uses the book value of debt not because they prefer it, but because market values of *debt* are never easily available; and fortunately, book values of debt (unlike equity) are often reasonably close to their market values. Financial debt is the sum of long-term debt and debt in current liabilities. In addition to financial debt, total liabilities include such obligations as current liabilities, pension liabilities, and the like, for which market values are typically not easily available.

➤ Balance Sheet and Capital Structure, Table 14.2, Pg.419.

[†]Rivian's IPO occurred in November 2021. RIVN reached $170/share shortly after the IPO, was at $104/share in late December, and under $50/share in March 2022. Thus its MV numbers depend on the day for which the information is downloaded. Moreover, equity includes some adjustments for investment tax credits and preferred equity. These days, few large publicly traded firms issue preferred equity, so this rarely makes much difference. (See also Page 508 on Preferred Equity.) In this case, only Rivian (newly public) had preferred equity. (Indeed, its common equity was negative.)

Calculating market value.

On December 31, 2021, HMC had 1.7 billion shares outstanding and a closing price of $28 for an equity market cap of about $49 billion. The **enterprise value** is this market cap of the equity ($49) plus debt ($66) etc., minus cash ($23, not shown), here about $92 billion. The **market value of the firm** (not of the equity) is total assets ($198) minus book equity ($70) plus market equity ($52), or $178 billion. Toyota's book and market value of equity were about the same, while Ferrari and Rivian had much higher market-values than book-values.

Let's compute various ratios for Honda.

Without further ado, here are some of the more interesting and common ratios for our four automobile companies. Be aware that many of these ratios exist in various flavors. The ratio discussion is ordered, 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.)

➤ 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 financial distress. Moreover, if it wants to borrow more money, then it should consider that potential new creditors often use such ratios to judge how likely the firm is to default. (They will also often judge indebtedness relative to profitability, cash flow, and industry.)

First are debt-equity related (leverage) ratios:

Different indebtedness ratios

Debt-to-equity ratios and liabilities-to-equity ratios come in many variations. For example, the debt-to-equity ratio is best defined in terms of market value of equity:

	Honda	Toyota	Ferrari	Rivian
BV Fin'l Debt / MV Equity	$65.9 / $49.1 ≈ 134%	$218.2 / $256.1 ≈ 85%	$3 / $47.6 ≈ 6%	$1.4 / $93.3 ≈ 2%

A broader ratio adds non-financial liabilities:

	Honda	Toyota	Ferrari	Rivian
Total Liabilities / MV Equity	$106.1 / $49.1 ≈ 216%	$328 / $256.1 ≈ 128%	$5.3 / $47.6 ≈ 11%	$2.8 / $93.3 ≈ 3%

Honda was substantially more levered than its competitors on all metrics.

If you use the book value of equity, which you can find on the balance sheet, Honda does not look so highly levered:

	Honda	Toyota	Ferrari	Rivian
Total Liabilities / BV Equity	$106.1 / $93.1 ≈ 114%	$328 / $227.9 ≈ 144%	$5.3 / $2.6 ≈ 202%	$2.8 / $19.5 ≈ 14%

However, recall that the book-value of equity is just a placeholder. Ferrari, with its $5 billion of liabilities, is almost surely not in trouble given its market value of $48 billion.

More indebtedness ratios

The ratios in the weighted average costs of capital (WACC) formulas divide not by equity but by the total value of all financial claims or assets.

Debt ratios add the value of debt to the denominator in a leverage ratio. Because the market value of debt is not available, we use the book value of debt. Adding debt and equity values, we obtain a market value of financial claims. For example,

	Honda	Toyota	Ferrari	Rivian
Long-Term Fin'l Debt / MV Fin'l Claims	\$39 / \$115 ≈ 34%	\$125.4 / \$474.3 ≈ 26%	\$2.4 / \$50.6 ≈ 5%	\$1.4 / \$94.8 ≈ 2%

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

You may also run into a definition for the firm's debt ratio that divides financial debt by total assets. (For Honda, it would be \$49.1/\$193.3 ≈ 25%.) The debt-to-asset ratio is one of the easiest ratios to compute, which is why it is very common — and best considered misleading or outright wrong. Consider two simple firms:

	Assets	Financial Debt	Nonfinancial Liabilities	Book Equity	(Dumb) Debt Ratio (FD/A)
Firm A	\$200	\$100	—	\$100	50%
Firm B	\$1,000	\$100	\$800	\$100	10%

Firm A has the same financial debt and equity as firm B. It is also financially more solid and less indebted. Nevertheless, the financial-debt-to-asset ratio (FD/A) incorrectly shows that firm A has a much *higher* debt ratio.

A smarter and more comprehensive indebtedness ratio is

	Honda	Toyota	Ferrari	Rivian
Total Liabilities / Total Assets (BV)	\$106.1 / \$193.3 ≈ 55%	\$328 / \$552.6 ≈ 59%	\$5.3 / \$7.8 ≈ 68%	\$2.8 / \$22.3 ≈ 12%

This version here is moderately misleading because it uses the firm's book value of equity (implied in its use of the book value of assets). Thus, Honda looks less indebted than Ferrari. A better version could use the market value of assets.

More indebtedness measures

Other measures of indebtedness can be useful and informative, too.

Times interest earned (TIE) and Interest Coverage are often used to gauge solvency. TIE is computed as earnings before interest (usually also before taxes) divided by the firm's interest expense.

	Honda	Toyota	Ferrari	Rivian
OperIncome (aftDep) / Interest Expense	\$1.9 / \$0 ≈ 71	\$6.3 / \$0.1 ≈ 84	\$0.3 / \$ ≈	–\$1.8 / \$0. ≈ –81

Honda had very low interest payments. Indeed, it earned almost as much from its various cash holdings as it paid its creditors. (If it had earned more, the 1/X

problem would have bitten us.) Thus, Honda's operating income is more than 70 times its net interest expense. If Honda will go bankrupt, it will not be from financial distress due to excessive debt. (Instead, it will be from failing to build competitive cars.) Rivian seems far more at risk than Honda. It better start earning positive cash flow sometime!

The definition of **interest coverage** is not standardized The most common definition is either Times-Interest-Earned (TIE) or its reciprocal. 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.

Method	Large Firms (Sales > $1 b)	Small Firms (Sales < $1 b)
Debt/EBITDA	(74%)	(63%)
Credit Rating	(64%)	(17%)
Interest Coverage (EBITDA/Interest)	(49%)	(57%)
Debt/Assets (Bad!)	(29%)	(52%)
Debt/Value	(23%)	(17%)
Debt/Equity	(15%)	(31%)
Liabilities/Assets	(9%)	(40%)

Figure 15.10: *CFO Usage Frequency of Leverage (Indebtedness) Measures.* Debt/value is probably (financial) debt divided by debt plus equity.
Source: John Graham (JF 2022)

Exhibit 15.10 shows how CFOs claim to measure leverage. The measures are all interesting, but their rank-ordering and relative importance seem strange. Why would small firms not care as much about their credit ratings as large firms? Why is debt/EBITDA more popular than EBITDA/interest? The former ignores whether interest rates are high or low. Why don't firms care more about their total liabilities? Frankly, we do not know, and fortunately, it isn't too important. The important aspect is for managers to understand and be able to measure when their situation becomes more precarious.

Precariousness Measures

Leverage and precariousness measures are often restricted to the short-term:

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.). A low ratio can mean efficient operation, precarious operation — or both.

	Honda	Toyota	Ferrari	Rivian
Current Assets / Current Liabilities	\$66 / \$47.9 ≈ 138%	\$188.2 / \$175.3 ≈ 107%	\$3.8 / \$0 ≈ ?%	\$18.6 / \$1.3 ≈ 1,413%

Honda's operations are less efficient or more cautious than those of Toyota. Rivian is still cash- and inventory-rich. Ferrari has raced headlong into the 1/X problem.

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 other current assets, it is less easily liquidated.

	Honda	Toyota	Ferrari	Rivian
(Current Assets – Inventories) / Current Liabilities	\$50.3 / \$47.9 ≈ 105%	\$158.1 / \$175.3 ≈ 90%	\$3.2 / \$0 ≈ ?%	\$18.3 / \$1.3 ≈ 1,393%

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

➤ Duration, § 5.1, Pg.84.

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. They are not ordinary ratios that can be calculated from the financial statements, in the sense that they require projections of future cash flows.

➤ Operations Turnover-Related Ratios

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

Turnover ratios divide sales by another number, usually by a component of net working capital. (A variant uses "cost of goods sold" instead of sales as the numerator.) Note that growing or shrinking firms typically and naturally have very different ratios compared to stable firms. For example, even if all goods are bought and sold within a quarter, growing firms must build more inventory one quarter before the sales realize.

Receivables turnover.

A high ratio for a current asset can mean efficient management. For example, for receivables

	Honda	Toyota	Ferrari	Rivian
Sales / Receivables	\$30.1 / \$20.2 ≈ 149%	\$63.3 / \$86 ≈ 74%	\$1.3 / \$1.5 ≈ 83%	\$0.1 / \$0 ≈ 208%

Honda's customers tend to pay in cash, whereas Toyota's and Ferrari's customers do not. (Rivian still has to find customers!)

In terms of inventory efficiency, the three established car companies are about equally efficient:

Inventory turnover.

	Honda	Toyota	Ferrari	Rivian
Sales / Inventory	\$30.1 / \$15.6 ≈ 192%	\$63.3 / \$30.1 ≈ 210%	\$1.3 / \$0.6 ≈ 206%	\$0.1 / \$0.3 ≈ 20%

Many firms also describe 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 off their inventories at a discount.)

What about paying their own bills? Honda pays its suppliers faster than Toyota, which pays its suppliers faster than Ferrari:

Payment morale

	Honda	Toyota	Ferrari	Rivian
Sales / Payables	\$30.1 / \$9 ≈ 335%	\$63.3 / \$33.9 ≈ 187%	\$1.3 / \$0.9 ≈ 139%	\$0.1 / \$0.5 ≈ 11%

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** divides accounts receivable by total sales and multiplies by the number of days per year.

Quoted in number of days.

	Honda	Toyota	Ferrari	Rivian
$\frac{365 \times \text{Receivables}}{\text{Sales}}$	245 days	493 days	440 days	176 days

We can guess that fewer Honda customers lease or finance their vehicles than Toyota or Ferrari customers. **Days inventories outstanding** is inventory divided by total sales on credit, times number of days outstanding.

	Honda	Toyota	Ferrari	Rivian
$\frac{365 \times \text{Inventory}}{\text{Sales}}$	190 days	174 days	177 days	1,825 days

Honda held more inventory than Toyota and Ferrari. Rivian is still building up its sales channel. **Days payables outstanding** (**DPO**) is accounts payable divided by total sales on credit, times number of days outstanding.

	Honda	Toyota	Ferrari	Rivian
$\frac{365 \times \text{Payables}}{\text{Sales}}$	109 days	195 days	263 days	3,318 days

If you are a supplier, you may want to be more cautious when selling to Ferrari or Rivian than to Honda.

There are also combined versions, such as ratios about 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. A different kind of measure is the following:

More joy for ratio nerds

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

	Honda	Toyota	Ferrari	Rivian
Sales / Total Assets (BV)	\$30.1 / \$193.3 ≈ 16%	\$63.3 / \$552.6 ≈ 11%	\$1.3 / \$7.8 ≈ 16%	\$0.1 / \$22.3 ≈ 0%

Based on this "funny" number (that should not be believed), Honda and Ferrari produced more sales for each dollar of asset holdings.

Good logistics measures.

Turnover ratios and their derivatives (below) are especially important for firms in low-margin commodities and retail sectors, such as gas station operators, Wal-Mart, and Amazon. 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 companies' efficiencies relative to their competition.

➤ Measures of Profitability

"Return on ..." list.

Next are some accounting-based ratios to assess margins, profitability, and return.

net profit margin

The **net profit margin** (**NPM**), also **return on sales** (**ROS**) is

	Honda	Toyota	Ferrari	Rivian
Net Income / Sales	\$1.6 / \$30.1 ≈ 5%	\$6.4 / \$63.3 ≈ 10%	\$0.2 / \$1.3 ≈ 18%	–\$2.5 / \$0.1 ≈ –45.57

Honda's low net profit margin is probably the reason why its stock-market cap is so low. It earns a lot less per car sold than Toyota and Ferrari.

return on book assets — Yikes 😬!

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

	Honda	Toyota	Ferrari	Rivian
Net Income / Total Assets (BV)	\$1.6 / \$193.3 ≈ 1%	\$6.4 / \$552.6 ≈ 1%	\$0.2 / \$7.8 ≈ 3%	–\$2.5 / \$22.3 ≈ –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. I tend to think of the earnings-price (E/P) yield as a better, market-based ROA measure.

➤ Warning about BV stock numbers, § 14.7, Pg.445.

return on book equity — yuck!

The **return on (book) equity** (**ROE**) divides net income by the book value of equity. I did not like dividing by the book-value of assets, and I really hate dividing by the book-value of equity. For completeness, the ROE is

	Honda	Toyota	Ferrari	Rivian
Net Income / BV Equity	\$1.6 / \$93.1 ≈ 2%	\$6.4 / \$227.9 ≈ 3%	\$0.2 / \$2.6 ≈ 9%	–\$2.5 / \$19.5 ≈ –13%

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. This is the case, e.g., for the ROA and ROE variables.

Timing when stock and flow measures are both included.

The so-called **DuPont model** multiplies and divides a few more quantities into the definitions of ROE in an attempt to learn more about their drivers — which, given the shortcomings of ROE, seems largely misguided. No investor should care about ROE. They should care more about market-based measures and rates of return, instead. Sigh.

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

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

The following tells you that Ferrari's ROE was so much higher than Honda's and Toyota's because Ferraris have higher net margins:

	Honda	Toyota	Ferrari	Rivian
Net Income / Sales	\$1.6 / \$30.1 ≈ 5%	\$6.4 / \$63.3 ≈ 10%	\$0.2 / \$1.3 ≈ 18%	–\$2.5 / \$0.1 ≈ –45.57

	Honda	Toyota	Ferrari	Rivian
Sales / Total Assets (BV)	\$30.1 / \$193.3 ≈ 16%	\$63.3 / \$552.6 ≈ 11%	\$1.3 / \$7.8 ≈ 16%	\$0.1 / \$22.3 ≈ 0%

	Honda	Toyota	Ferrari	Rivian
Total Assets (BV) / BV Equity	\$193.3 / \$93.1 ≈ 208%	\$552.6 / \$227.9 ≈ 242%	\$7.8 / \$2.6 ≈ 298%	\$22.3 / \$19.5 ≈ 114%

Ferraris have higher markups than Hondas and Toyotas, which is the primary reason why Ferrari has a higher ROE. Toyotas have higher markups than Hondas, but Honda compensates by producing more sales for each dollar of asset.

➤ Measures Related to Stock-Market Capitalization

Our final category includes auxiliary measures that are more market-oriented.

Measures that are more oriented toward shareholders and 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 hints at how much it would cost to replace assets. (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 so 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.

	Honda	Toyota	Ferrari	Rivian
BV Equity / MV Equity	\$89.7 / \$52.1 ≈ 172%	\$222.9 / \$218.2 ≈ 102%	\$2.6 / \$47.6 ≈ 6%	\$19.5 / \$93.3 ≈ 21%

On this metric, Ferrari is the not only the fastest-car maker but also the fastest-growing car maker. With its exceedingly low book value of equity, Ferrari's market value of equity is a stunning 18 times larger than its book value. If the book value is any indication of liquidation value, Honda's shareholders would be better off if Honda liquidated its assets and returned all the money to its shareholders asap.

The dividend payout ratio measures what percent of earnings companies pay out as dividends. Holding everything else equal, the same firm that pays out more of its earnings *today* would reinvest less and therefore pay out less *in the future*.

	Honda	Toyota	Ferrari	Rivian
Dividends / Net Income	\$1.3 / \$5.9 ≈ 22%	\$5.7 / \$20.3 ≈ 28%	\$0.2 / \$0.9 ≈ 19%	–?%

All three established automakers paid out a good fraction of earnings to shareholders. Honda and Ferrari presumably reinvested more in the business than Toyota. Rivian paid no dividends and had negative net income.

Note that unlike the **payout ratio**, the dividend payout ratio does not include equity repurchasing activity, another mechanism by which firms can return cash to their shareholders. (Remaining shareholders then benefit by owning more of the firm.) The **plowback ratio** (also called **retention ratio**) is one minus the dividend payout ratio, though it would make more sense also to take equity repurchasing activity into account.

➤ Dividend yield, § 2.3, Pg.13.

The dividend yield is the amount of dividends divided by the share price.

➤ Equity payouts, § 20, Pg.645.

	Honda	Toyota	Ferrari	Rivian
Dividends / MV Equity	\$1.3 / \$52.1 ≈ 3%	\$5.7 / \$218.2 ≈ 3%	\$0.2 / \$47.6 ≈ 0.4%	\$0 / \$93.3 ≈ 0%

Both Honda and Toyota offered shareholders dividend yields larger than prevailing interest rates. 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**.

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

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 your firm reports 7 days — you should puzzle about the economics of this shorter number. Is your firm better in squeezing its customers more 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?

Q 15.22. How would you measure a financial-debt-equity ratio?

Q 15.23. What is the "current ratio"? Is a firm more or less precarious if this ratio is high?

Q 15.24. A firm has sales of \$30,000 and receivables of \$6,000. What is its receivables turnover? What is its DRO?

Q 15.25. 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 (and even discount rates). 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 probably end up rich. (My money is on you, my reader, instead on students having read other finance textbooks.)

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 — a fact that 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. Doing so can lead to all sorts of strange implications. Don't take P/E ratios too literally.
- The 1/X domain problem is terrible. 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, p.36; average collection period, p.37; book value of equity, p.28; book-to-market ratio, p.39; cash conversion cycle, p.37; current assets, p.36; current liabilities, p.36; current ratio, p.36; days inventories outstanding, p.37; days of sales outstanding, p.37; days payables outstanding, p.37; days receivables outstanding, p.37; debt-to-equity ratio, p.33; dividend payout ratio, p.40; dividend yield, p.40; dividend-price ratio, p.40; dpo, p.37; dro, p.37; dso, p.37; dupont model, p.39; duration and maturity, p.36; earnings-price yield, p.16; enterprise value, p.33; forward earnings estimate, p.9; interest coverage, p.34; interest coverage, p.35; liabilities-to-equity ratio, p.33; market value of the firm, p.33; most recent quarter, p.18; mrq, p.18; net profit margin, p.38; npm, p.38; p/e, p.2; p/e ratio, p.2; pair trading, p.23; payout ratio, p.40; peg ratio, p.27; plowback ratio, p.40; price-earnings ratio, p.2; price-to-book, p.28; price/sales, p.29; pvgo, p.11; quick ratio, p.36; retention ratio, p.40; return on (book) assets, p.38; return on (book) equity, p.38; return on sales, p.38; roa, p.38; roe, p.38; ros, p.38; tie), p.34; times interest earned, p.34; total asset turnover, p.38; trailing earnings estimate, p.9; trailing twelve months, p.18; ttm, p.18; valuation ratio, p.27.

Answers

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

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

AQ 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."

AQ 15.4 In 2022, GOOG was at 25 while PepsiCo was at 30. Go figure. Google is so big, it may no longer be growing fast. (Theory is easier than practice!)

AQ 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 $66.7/40 - 1 \approx 67\%$.

AQ 15.6 Rearranging Formula 15.3,

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

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.

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

AQ 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.

AQ 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.

AQ 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.

AQ 15.11 Averaging P/E ratios is very hazardous because it can easily lead to misleading estimates, as explained in Section 15.4. This overlaps with "1/X domain problem" that earnings can be non-positive or tiny.

AQ 15.12 If only one among a dozen industry comps has a negative P/E ratio, you can ignore this firm with non-positive 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.

AQ 15.13 This can change year by year.

AQ 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!

AQ 15.15 Firms with high P/E ratios usually have higher PVGOs. Using the formula in Table 15.4, you can see that

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

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

AQ 15.16 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!

AQ 15.17 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.

AQ 15.18 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.

AQ 15.19 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.

AQ 15.20 We could consider different benchmark metrics according to what we have here.

	KO	KDP	PEP	Nestlé ?
Market Cap / Employees	3.27	2.00	0.72	$213b
Market Cap / Revenue	6.78	4.26	2.82	$212b
Market Cap / Net Income	26.81	25.16	29.40	$250b

Nestlé was actually worth $356 billion on Mar 21, 2022. (Its ratios were 1.3, 4.2, and 21, respectively. If you had chosen only KDP as the peer, your estimate would have been more accurate — even a stopped clock is right twice a day.)

AQ 15.21 The obvious weird outlier is Apple's D/E ratio. With $123 billion debt and $2.53T in market-value, the debt ratio should be more like 1/20 than 170/1. The first reason for this discrepancy is that Yahoo uses book-value-based equity. For Apple, the book value of equity was about $65 billion, not $2.53 trillion. Still, this gives a debt ratio of about 2/1, not 170/1. At the same time, other financial data providers reported much smaller debt ratios. For example, Bloomberg reported a debt-to-asset ratio of 0.3, i.e., about a 2/1 ratio.

We can first calculate valuation ratios, either for the market value (MV) of equity (MVE) or the MV of debt plus equity. In this case, the value of debt is so small that it makes little difference for the value. The standard deviation is a good measure of how reliable the ratios are. For MVE/cash, the standard deviation is 16. For MVE/sales, it is 2.6. For MVE/OCF, it is 14 (levered) and 27 (unlevered). Therefore, the best ratio would probably have been a MVE/sales ratio — but it would still have been pretty lousy at 2.6.

AQ 15.22 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.

AQ 15.23 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.)

AQ 15.24 Its receivables turnover is $30,000/$6,000 = 5 times per year. DRO is $365 \cdot \$6{,}000/\$30{,}000 = 73$ days.

AQ 15.25 The dividend-price ratio divides dividends by price; the dividend payout ratio divides dividends by net income.

End of Chapter Problems

Q 15.26. What are the three main requirements for a comps-based valuation?

Q 15.27. 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 15.28. Is it better to compute a price-earnings ratio on a per-share or aggregate (total value) basis?

Q 15.29. Is it better to use cash flows or earnings in your valuation multiple? Why?

Q 15.30. Which is likely to have a higher price-earnings ratio: Google or Exxon?

Q 15.31. 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 15.32. 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 15.33. 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 15.34. 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 15.35. 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 15.36. 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 15.37. Use Ford's P/E ratio to value General Motors *today* (not in late 2021).

Q 15.38. 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 15.39. Compute rolling TTM earnings numbers for Honda over the most recent four quarters.

Q 15.40. What are the main problems of comparables valuation? Give an example of each, preferably real-world or numeric examples.

Q 15.41. Is there a problem with using a book-value-based equity measure? If so, why, and when does it matter?

Q 15.42. How could you value a biotech start-up that has no sales or earnings?

Q 15.43. What is the "quick ratio"? Is a firm more or less precarious if this ratio is high?

Q 15.44. What ingredients are in the DuPont model? What is its most important problem?

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