9

Benchmarked Costs of Capital

As an investor, your problem is to form good portfolios. As a corporate manager, your problem is how to get your own firm into other investors' portfolios. So you need to know the right discount rate at which they will bite. In earlier chapters, this discount rate was just time-based and all you had to do was to offer the same expected rate of return. In this chapter, we begin adding a risk component.

We will now assume that your investors simply benchmark all investment opportunities (including your stocks, bonds, projects, etc.) to other prominent asset classes in the economy. In particular, we assume that they will evaluate your firm based on two characteristics: (1) whether your project payoffs are more like short-term or long-term investments; and (2) whether your payoffs are more like safe debt or risky equity. Safe bond-like projects can get away with offering investors lower average rates of return; risky stock-like investors must offer higher expected rates of return. This means we need to take another look at bills, bonds, and stocks in the overall economy. What is the appropriate risk-free rate of return for projects of similar durations, and what is the equity premium for the expected rate of return on stocks above bonds?

9.1 What You Already Know

You are still after an estimate for your opportunity cost of capital.

Let's take stock (pun!). You already know the right train of thought for capital budgeting purposes: As a corporate manager, your task is to determine whether you should accept or reject a project. You make this decision with the NPV formula. To determine the discount factor in the NPV formula, you need to estimate the appropriate cost of capital—or, more precisely, the *opportunity* cost of capital for your investors. This means that you need to judge what a fair expected rate of return, $E(r)$, is for your project, given your project's characteristics. When compared to "similar" projects elsewhere, if your project offers a lower expected return, then you should not put your investors' money into your own project but instead return their money to them. If your project offers a higher expected return, then you should go ahead and invest *their* money into *your* project. Put differently, your goal now is to learn what your investors, if asked, would have wanted you to invest in on their behalves. Of course, it still remains difficult to determine what "similar" is, but this is a devil in the details.

What do investors like?

Unfortunately, the perfect market assumptions of Utopia are no longer enough to proceed. You must begin to speculate more about your investors' preferences. What do investors like and dislike? You already know two relevant project attributes:

Far-Off vs. Nearby Payments: Long-term Treasury bonds have (usually) been offering higher yields *per-annum* than short-term Treasury bills. Presumably, this is because investors are more reluctant to part with their money when payment is farther down the line. In this sense, you can think of long-term as "toxic" relative to short-term. Investors (usually) seem to like getting money sooner.

Equities vs. Bonds: The stock market has offered higher average rates of return than the bond market. Presumably, this is because investors are more reluctant to part with their money when all they get is a fuzzy risky claim, like equity, with repayment depending more on success. In this sense, you can think of equity as "toxic" relative to bonds. Investors like getting money with less variance.

(A quick clarification: high expected rates of return usually mean that investors dislike an asset's attributes—this asset could *not* be sold for a high price because investors needed to be compensated extra for something.)

Et tu, Brutus?!

As an executive, you should assume that if investors dislike an attribute in the wider financial markets, they will also dislike it in your own projects. If you offer them a project that pays off more like stock-market equity, it has to offer the higher expected rate of return of stocks. If you offer them a project that pays off more like bond-market principal and interest, it can offer the lower expected rate of return of bonds. And if you compare two projects, one with payoffs farther in the future than another, the former should offer higher expected returns—just as long-term bonds offer higher expected returns than short-term bills. The focus of this chapter is therefore to assess what rates of return you can expect in these different types of investment.

Firms that are just funds are good examples where this must work.

In a perfect market, these rules must surely be correct for the most simple of all investment projects: Firms that do nothing but invest in Treasury bonds (i.e., fixed income investment funds) should offer about the same expected rates of return as their Treasury bonds. If they offer lower expected returns, investors can buy the bonds themselves. If they offer more, investors will quickly bid up the price of the fund until the expected returns become about the same. The same is true for equity. Firms that do nothing but hold S&P 500 stocks should offer about the same expected rates of return as the S&P 500. And firms that invest 50-50 should offer 50-50.

Now what?

The big question of this chapter is: how can you assess the appropriate expected rate of return on the standard benchmarks, i.e., on risk-free investments and on stocks? In the next chapter, you will learn methods to judge how similar projects are to each of these benchmarks.

9.2 The Risk-Free Rate — Time Compensation

Nominal or Real?

How do you assess the risk-free rate of return (r_F)? Most corporations want the nominal rate from U.S. Treasuries, because they want to discount nominal cash flows. In the rare case that a corporation needs to discount real cash flows, the U.S. Treasury also offers quotes on inflation-adjusted real bonds (TIPS).

Which risk-free rate?

➤ US Treasuries, Sect. 5.3, Pg.86.

There is one small issue, though—which Treasury? What if the yield curve is upward-sloping (as it usually is)? For example, in mid-2016, Treasuries yielded 0.1% per annum over one year, 1.8% over five years, and 3% over thirty years.

Advice: Pick the interest rate for a Treasury that is "most similar" to your project.

So think about the basics of your own project. You want to match your projects' cash flows to the most similar risk-free bond benchmark. You should choose the risk-free bond yield that most closely mirrors the specific expected cash flows. For example, to value a safe project that operates for three years, use the 1-year Treasury yield to discount the expected cash flow for the first year's NPV term, the 2-year Treasury for the second year's NPV term, and the 3-year Treasury for the third year's NPV term. If you had to use just one risk-free rate for multiple cash flows (because your Dilbertian boss says so), choose an average of the three rates or simply the 2-year bond. There are better duration-matching ways to do this, but unless you are a bond trader, the extra precision is rarely worth it.

Matching cash flows to similar maturity bonds is not a law of nature but a reasonable (and loose) approach. Think about the opportunity cost of capital for a small investment that does not vary systematically with anything else. If your corporation's investors are willing to commit their money for ten years, they could earn the yield on a ten-year risk-free bond instead. It is this ten-year rate that would then be more indicative of the opportunity cost of capital on your own project cash flow that will materialize in ten years than, say, a one-year or thirty-year bond. If your project's cash flow will occur in three months, your investors could alternatively only earn the lower rate of return on the three-month bill.

But don't we need formal guidance? Isn't this violating the letter of the law?

Of course, to your investors, your project's cash flows are not likely to be exactly like the analogous U.S. Treasury payments. Thus, you can consider some refinements. It may be more appropriate to use an opportunity cost more similar to corporate than to Treasury bonds. Fortunately, for short-term corporate bonds issued by investment-grade companies, after you take into account that quoted yields have to be reduced by the expected default premium, the average historical rate of return has been almost the same. For long-term non-investment-grade (i.e., high-yield) bonds (except perhaps mortgages), the cost of capital may be considerably higher.

Corporate interest rates?

➤ default premium, Sect. 6.2, Pg.113.

Q 9.1. What is today's risk-free rate for a 1-year project? For a 10-year project?

Q 9.2. If you can use only one Treasury, which risk-free rate should you use for a project that will yield \$5 million each year for 10 years?

9.3 The Equity Premium — Risk Compensation

Appropriate compensation for a risk-free investment over a given time frame is the easy part. This is the cost of risk-free capital. Now comes the hard part: appropriate compensation for taking risk. This is the cost of risky capital. Although most corporate projects are not risk free, you can think of them as some combination of a safe part (a debt-financed claim) and a risky part (an equity-financed claim). Indeed, you have already learned that you can always split a medium-risky project into claims that have safer and riskier payoffs. Therefore, you usually need to know the appropriate cost of capital on the risky part, too—the task at hand now.

Think of projects as part risk-free, part risk.

➤ Splitting payoffs, Sect. 6.4, Pg.123.

Unfortunately, the expected rate of return on risky assets is much more difficult to estimate than the risk-free rate. First, what is a good benchmark for risk? Hmmm...What is the most canonical risky asset in the economy? The stock market! We financiers usually rely on a benchmark

Work with the equity premium

$$\textbf{Equity Premium} \equiv E(r_M) - r_F \ , \tag{9.1}$$

which is the extra expected rate of return that risky equity projects have to offer above and beyond what risk-free bonds are offering. (It is a difference of two rates, so you can use either two nominal or two real rates.) Later, when you want to determine the expected rate of return on a project that consists only of one asset that is the stock market, say an S&P 500 fund, you would add back the interest rate you just subtracted out here. It is easier to think about the "extra" of the risk premium above the time premium (in the risk-free rate) rate. The equity premium $[E(r_M) - r_F]$ is also sometimes called the **market risk premium**. In common use, the terms can refer either to realized rates of return or expected rates of return, although the latter is more common and we will use it mostly in this sense in this chapter. (This ambiguity is not my fault.)

➤ Inflation, Sect. 5.2, Pg.82.

You want to know the equity premium

This equity premium is a number of first-order importance for everybody. It is not just the corporations want to know it for their cost-of-capital estimation. *You* also want to know it as an investor when you decide how much of your money you should invest in stocks rather than bonds. Unfortunately, in real life, the equity premium is not posted anywhere—and *no one really knows the correct number*. Worse: Not only is it difficult to estimate, but the estimate often has a large influence over all financial decision-making. *C'est la vie!*

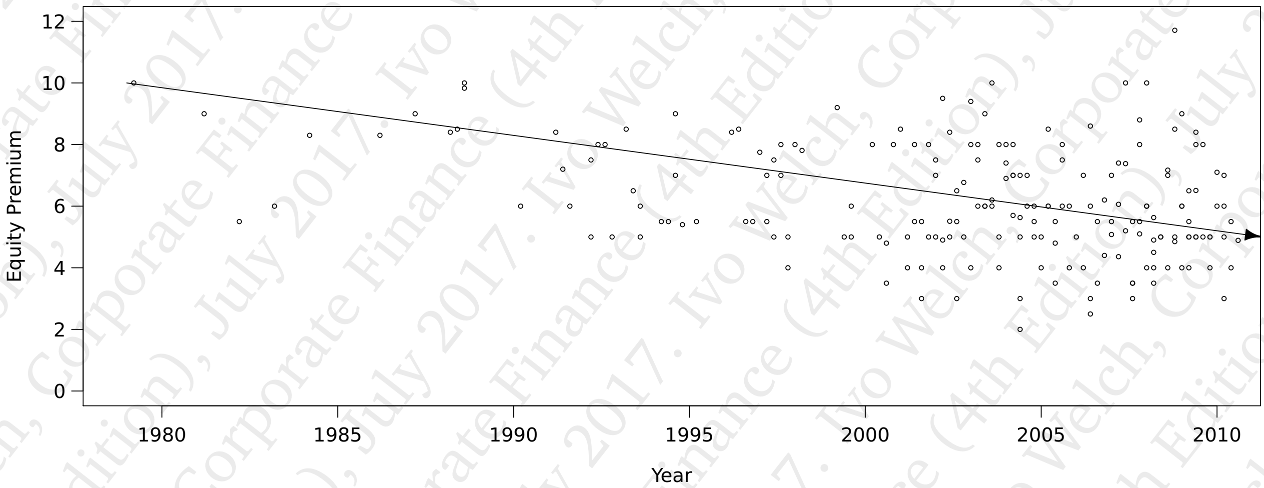

Exhibit 9.1: *Equity Premia from Different Textbooks. Source: Pablo Fernandez, SSRN, 2013.*

Should I just give it to you?

Fortunately, there are a number of methods to guestimate the equity premium. Unfortunately, for many decades now, these methods have disagreed with one another. It should thus come as no surprise to you that practitioners, instructors, finance textbook authors, and everyone else have been confused and confusing. For example, each finance textbook seems to have its own little estimate, as you can see in Exhibit 9.1. Both the disagreement and the average recommended estimate seem to have been slowly declining over the decades.

Let's show you how people are reasoning.

So "we" finance-textbook authors have two choices:

1. We can throw you one estimate, pretend it is the correct one, and hope that you won't ask questions. It would be a happy fairy tale ending. Unfortunately, it would also be a lie.
2. We can confess to the truth. We can tell you how different methods can lead to different estimates—and how we are really all in the same boat. Worse, we are not sure where the boat has holes.

In this book, I am going to take the second route. I will explain to you what each method suggests and actually means. You can then make up your own mind as to what you deem to be best. (I will tell you my own personal estimate at the end.) This also has an important advantage: you won't be surprised if your boss uses some other equity premium to come to different conclusions. At least you will understand why.

Let's discuss one-by-one—and in order of prominence—the six most prominent methods that form the bases of common equity-premium estimates.

Method 1. Historical Averages I

The first and most common guesstimation method is to assume that whatever the average equity premium was in the past will also be the case in the future. And the past century has been pretty good to us.

Historical average returns.

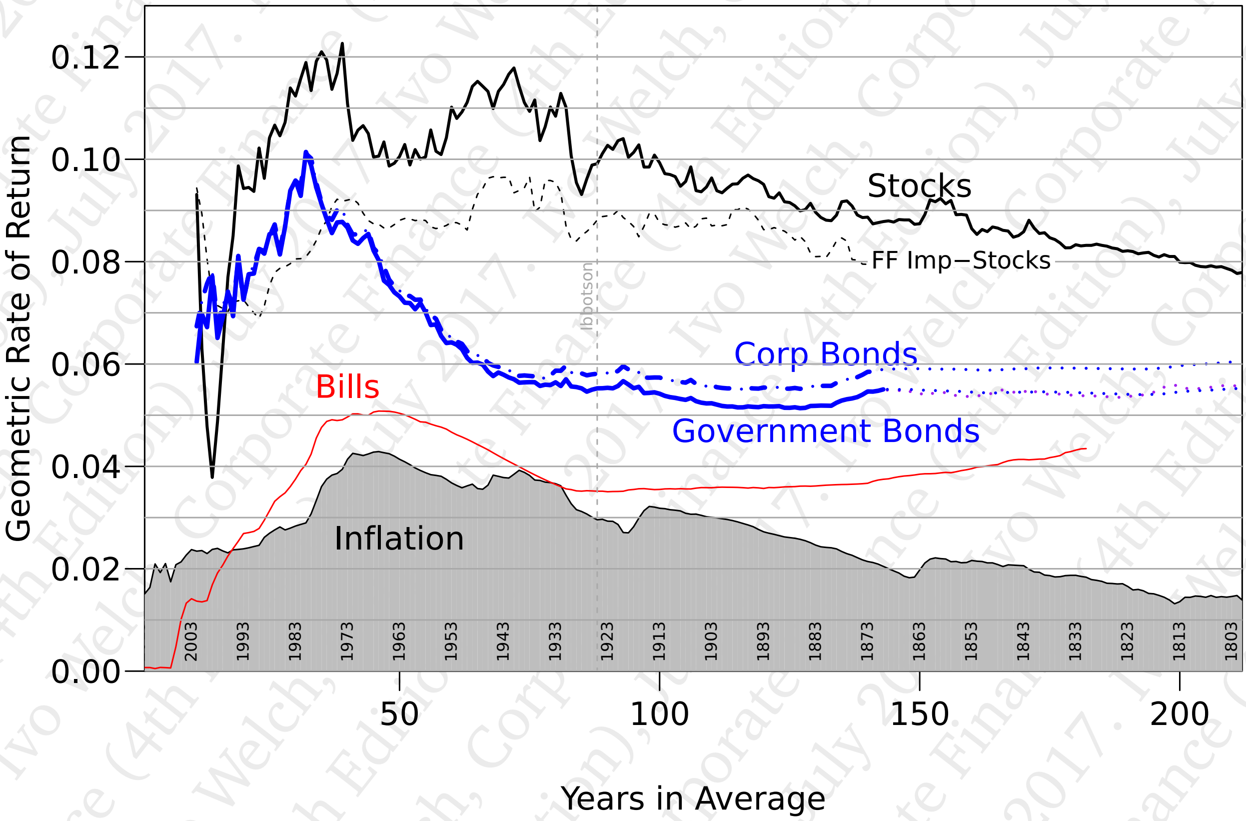

Exhibit 9.2: *Asset Class Geometric Rates of Return. Source: Levi-Welch, JFQA, 2017. This graph is* backward*-looking. If you want to know what conclusions you would draw from the data since 1963, you look at the first notch on the X-axis. If you want to know what conclusions you would draw from the data since 1863, you look at the third notch on the X-axis. The most recent 10 years were omitted, because such an experience would be too short to draw conclusions and the lines would become too jagged. The equity premium is the difference between the black "Stocks" line and either the blue "Bonds" or the red "Bills" lines. For example, the equity premium above US Treasury Bonds measured from 1975 to 2015 (i.e., about 40 years) was about 2% per annum..*

Exhibit 9.2 plots the average *geometric* performance of the stock market (with dividends) over the last x years. You choose your point on the x axis based on how relevant you consider more recent vs. older historical data. The graph also shows the rate of return on (long-term) corporate bonds, long-term Treasury bonds, short-term Treasury bills, and inflation. The difference between the black stock market line and the red line is the short-term equity premium. The difference between the black stock market line and the blue fixed-income lines are long-term equity premia.

Cut to the chase.

➤ Geometric vs. Arithmetic Returns, Sect. 7.1, Pg.142.

- Over the last 50 years, stocks have outperformed both long-term Treasury and corporate investment-grade bonds by about 2%/year (compounded). However, over the last 100 years, they have outperformed by a larger margin of about 4%/year.

- Over the last 100 years, stocks have outperformed short-term bonds by about 4-5%/year.

Let's discuss these estimates and their interpretation in more detail. In particular, we want to be clear about how to deal with these benchmarks for assessing your own short-term projects and long-term project opportunities. Most interesting corporate projects, like factories, buildings, research, or brand names, deliver cash flows over many years.

The Stock Market is a Long-Term Asset

What is the average return on the S&P 500?

A natural way to think of premium is to think of a clean decomposition into a term premium and a risk premium. The empirical evidence has shown that most of the value of stocks comes from their long-term payoffs (decades off), and not in their payoffs over the next few years. The stock market should be viewed as a (very) long-term investment.

Risk Holding Term Constant

Consequently, if you are interested in measuring the risk-premium, you should subtract the rate of return on long-term bonds from the rate of return on stocks. If you instead subtract the rate of return on short-term bills, you end up with the sum of the term premium and the risk premium.

Last 50 years: Stocks - Short-Term Bills = 3% Term + 2% Risk

According to Exhibit 9.2, the equity premium was the sum of the term premium of long-term bonds over short-term Treasury bills of about 3-4% over the last 50 years and 2% over longer histories; and the risk premium of about 2% over the last 50 years and 4% over the last 100 years. None of this is a problem. Different numbers just mean different things. The problems can arise later in the application. We have to keep in mind which is which.

Disagreeing About Estimates

The gamut of choices

➤ Geometric vs. Arithmetic Returns and Extrapolation, Sect. 7.1, Pg.142.

If you use 90 years of historical data, arithmetic rates of return, and a spread over short-term T-bills, you can settle on an equity premium estimate as high as 8%. This number is prominently quoted in many other finance textbooks. It is important to understand it, because so many people are still using it. It was etched in the minds of generations of students, practitioners, and finance professors. But it has a specific meaning and is based on a specific sample period. Worse, it is often misapplied.

Both the high 8% estimate and the lower 2% alternative estimate in Exhibit 9.2 follow from the same historical data. Let me explain the key difference between them:

Arithmetic Equity Premium 1926 to 2015 over Short-Term T-Bonds	≈ 8%
Instead use later Sample Period 1970 to 2015	–2%
Instead use Long-Term T-Bonds	–2%
Instead use Geometric Returns	–2%
Geometric Equity Premium 1970-2015 over Long-Term Bonds	≈ 2%

Equity Premium Puzzle

The 8% figure seems astonishingly high. It is often called the **equity premium puzzle**. (But can you really expect stocks to outperform bonds by a factor of $1.08^{50} \approx 50$ by the time you will retire in about 50 years? No!) This is the claimed superior performance of U.S. stocks over U.S. Treasury bills. Exhibit 9.2 is clear that since about 1970, it has been more of a term-premium puzzle. Long-term bonds outperformed short-term bills by about 3-4%. Stocks, themselves more long-term assets, have outperformed long-term bonds only by about 1-2%. Mmaybe we should argue more about the term premium puzzle and less about the equity premium puzzle. In contrast, the 2% figure seems low. For tax-exempt investments (e.g., your 401-K pension portfolio), 2% seems like a more reasonable amount of compensation for the risk.

Let's discuss the differences one by one:

1. **Sample Period?:** You have to judge what historical sample is appropriate. You probably want to end the sample recently (last year). But it is not clear whether you should start, say, in 1926 (which is when most of our common finance databases begin) or in 1970 (about half-way). Although your estimate can seem statistically more reliable if you use more years, using the long sample means that you are then leaning more heavily on a heroic assumption that the world has not changed. Are the world and its expected risk and reward choices really still the same today as they were in 1830, 1871, 1926, or 1970? (And is the United States really the right country to consider alone? Did it just happen to have had an unusually lucky streak during [the first half of] the "American Century," which is unlikely to repeat? In this case, the average country's experience may be a better forecast for today's United States, too.) No one knows the best sample choice. I prefer a shorter sample of half a century.

   Incidentally, as Exhibit 9.2 showed, the equity premium was lower in this 50-year sample not because (noisier) stocks performed worse (they did not), but because (less noisy) Treasury bonds performed better—and bonds continue to have higher yields than bills.

2. **Long-Term or Short-Term Bonds?:** You have to judge whether short-term or long-term bonds are the appropriate benchmark. From the perspective of a financial-market investor who can make daily reallocation decisions and shift effortlessly between risk-free T-bills and stocks, using the short interest rate as the benchmark makes sense. From the perspective of a manager who needs to decide about a short-term project, using short interest rates as the benchmark also makes sense. However, from the perspective of a corporate manager who needs to commit funds to a long-term project with cash flows over decades, it does not. It is not possible for corporations to quickly move in and out of decisions to build, say, power plants. Building a plant is a long-term decision. If all investors can earn higher yields in Treasuries if they commit their money for 20 years, and if your own plant requires them to commit their money for 20 years, too, then your plant should also be benchmarked to this long-term expected rate of return. Conveniently, the term spread between 1-year and 20-year risk-free rates (though not the rate of return on rolling over 1-year bills over 20 years) can be easily looked up on the web every day. There is little uncertainty.

3. **Geometric or Arithmetic?:** You have to judge whether you should use geometric or arithmetic rates of return in your benchmark cost of capital in the NPV formula. The answer is not clear, as you may recall from Section 7.1. There was a convention of assuming that past returns represent equally likely future outcomes, and many corporations compound the annual arithmetic average stock return or equity premium without much thought. However, doing so means that they expect the future multi-year stock performance relative to bonds to be better in the future than it was in the past. (For nit-pickers, the theoretically correct choice depends on the cash flow durations and suggests compounding the equity premium estimate somewhere between the arithmetic and geometric averages.)

   ➤ Geometric vs. Arithmetic Returns and Extrapolation, Sect. 7.1, Pg.142.

   But there is a simpler argument based on the rule of comparing apples to apples. How do you think about your own expected cash flows? I bet you do so in geometric terms. If you think in terms of arithmetic expected cash flows compounded over many periods—i.e., if you consider the expected cash flow on a project that first earns +200% and then –100% [for a complete overall loss] to be a success with a positive average rate of return, then you should use the arithmetic average. Hardly anyone thinks this way.

   We will return to compounding concerns in Section 9.4.

Was the 20th Century Really the "American Century?"

The compound rate of return in the United States was about 8% per year from 1920 to 1995. Adjusted for inflation, it was about 6%. In contrast, an investor who had invested in Romania in 1937 experienced not only the German invasion and Soviet domination, but also a real annual capital appreciation of about –27% per annum over its 4 years of stock market existence (1937–1941). Similar fates befell many other Eastern European countries, but even countries not experiencing political disasters often proved to be less than stellar investments. For example, Argentina had a stock market from 1947 to 1965, even though its only function seems to have been to wipe out its investors. Peru tried three times: From 1941 to 1953 and from 1957 to 1977, its stock market investors lost *all* their money. But the third time was the charm: From 1988 to 1995, its investors earned a whopping 63% real rate of return. India's stock market started in 1940 and offered its investors a real rate of return of just about –1% per annum. Pakistan started in 1960 and offered about –0.1% per annum.

Even European countries with long stock market histories and no political trouble did not perform as well as the United States. For example, Switzerland and Denmark earned nominal rates of return of about 5% per annum from 1920 to 1995, while the United States earned about 8% per annum. A book by Dimson, Marsh, and Staunton looks at 101 years of global investment returns and argues that measurement and hindsight biases can account for much of this superior return.

The U.S. stock market was an unusual above-average performer in most of the twentieth century. Will the twenty-first century be the Chinese century? And do Chinese asset prices already reflect this? Or already reflect *too much* of this?

Goetzmann and Jorion (1999)

Uncertainty About Historical Estimates and the Peso Problem

Yet another problem: your margin of error.

Forgive me, but I have not even mentioned another big problem: the large margin of error. The standard deviation of stock returns of 20%/year translates into a standard error of about $20\%/\sqrt{100} \approx 2\%$ if you use a 100-year sample. If you are willing to assume that the stock-market process has not changed over the last 100 years, and that stock returns are roughly normally distributed, then you can use some additional statistical artillery: You are then about 95% sure (a confidence range popular in statistics) that the true mean geometric stock return over long bonds was between 0% and 8% from 1926 to 2015. Frankly, this large a range on the appropriate cost of capital for equity is not the kind of accuracy you like when you have to decide where to invest your money. You already knew—or at least should have reasonably believed—that the equity premium should not have been negative.

Lucky—inference with rare outcomes.

To make matters even more complex, some economists believe that even the observed historical data are not telling the full story, either. Let me explain this by analogy. The odds in roulette are against you, with a payout of 1-in-35 when betting on a single number (out of 36 numbers). How good is a bet on the first 34 roulette numbers? Well, you will win 34/36 of the time, each time losing $34 and getting back $35 (i.e., 2.9%). After a run of 50 times, in which neither #35 nor #36 have showed up, you would incorrectly conclude that your expected rate of return is +2.9% per roll. Of course, this is delusional. But it's not completely impossible that you could have seen, say, 30 good rolls.

Lucky—quite possible.

Similarly, maybe we just happen to live in world in which the stock market has never rolled the worst outcomes. The true expected rate of return could be zero or even negative. Thus, these economists believe that disasters have been possible, but their probabilities have been tiny (say, 1-in-100 years)—and they just "happened not to have happened" in the last 100-200 years. The super-volcano did not blow; the asteroid did not hit. For example,

	Asteroid	Normal
Probability	0.01	0.99
Stock Return	–99%	+1%

True Average Expected Rate of Return: 0%
Average Rate of Return Given Luck of No Asteroid: 1%

Presumably, such a zero expected rate of return for a risky investment is as low as it could reasonably be. Trust me that there is about a 1-in-3 chance that over 100 years, not even one asteroid would have hit. If you happen to have lived in such a world—called "the U.S. of the last 100 years"—you would have calculated a historical average rate of return of 1%. Alas, it would be too optimstic an estimate of the true expected rate of return.

This is sometimes called the **Peso problem**, based on an otherwise obscure academic paper about the currency spread of the Mexican Peso. When you say "Peso problem," financial economists will know exactly what you mean!

The Peso Problem

There is some empirical evidence that investors behave exactly as if they fear such a Peso crash—but we do not know whether such a fear is (or was) rational and we are not sure how much of the historical equity premium it can explain. A reasonable order of magnitude is that extra compensation for crash risk could account for at most a 1-2%/year equity premium—and perhaps for nothing.

Peso Problem Magnitude

In Conclusion

If your estimate of the forward-looking equity premium is based on the "historical averages I" method, then you can defend a choice of 1% (for long-term cash flows). If you are aggressive, you can defend even a choice of 8% (for short-term cash flows), and equity premium ranges from 0% to beyond 10% if need be (or, more cynically, if you are an expert witness paid to so opine). Are you in awe or disgust about out uncertainty and the wide possible range of estimates here? For me, its both.

A sarcastic view: History ain't what it used to be!

Method 2. Historical averages II

The second method for estimating the equity premium is to look at historical realizations in the opposite light. Maybe stocks have become more desirable—perhaps because more investors have become less risk-averse. They would have competed to own more stocks, and thus have driven up the prices. This would imply lower expected rates of return in the future! High past rates of return would then be indicative of low future expected rates of return.

Inverse historical averages.

An even more extreme version of this argument suggests that high past equity returns could have been due not just to high ex-ante equity premiums, but also to historical "bubbles" in the stock market. The proponents of the bubble view usually cannot quantify the appropriate equity premium, but they do argue that it is lower after recent market run-ups—exactly the opposite of what proponents of the *Historical Averages I* guesstimation method argue. However, you should be aware that not everyone believes that there were *any* bubbles in the stock market, and few credible economists believe that the U.S. stock market over the entire century was one big bubble.

Sidenote: A **bubble** is a runaway market, in which rationality has (at least temporarily) disappeared. There is a lot of academic debate as to whether bubbles in the stock market have ever occurred. A strong case can be made that technology stocks experienced a bubble from around 1998 to 2000. It is often called the **dot-com bubble**, the **internet bubble**, or simply the **tech bubble**. I know of good fundamental-based explanations as to why the NASDAQ Index climbed from 2,280 in March 1999 to 5,000 by March 2000 and why it dropped from 5,000 back to 1,640 by April 2001—but no good non-bubble explanations for both.

Method 3. Current predictive ratios

Dividend or earnings yields.

The third method for estimating the equity premium is to try to predict the stock market rate of return actively with historical dividend yields (i.e., the dividend payments received by stockholders). Higher dividend yields should make stocks more attractive and therefore predict higher future equity premiums. This equity premium estimation is usually obtained in two steps:

1. Estimate a statistical regression that predicts next year's equity premium with this year's dividend yield
2. Substitute the currently prevailing dividend yield into your estimated regression formula in order to predict.

In mid-2016, dividend yields were so low that the predicted equity premium was negative—which makes no sense. Variations of this method have used interest rates or earnings yields, typically with similar results. In any case, the empirical evidence suggests that this method does not yield great predictions—for example, it predicted low equity premiums in the 1990s, which was a period of superb stock market performance.

Academics disagree whether such methods work for short-term equity-premium predictions (say 1-5 years). But all agree that we do not have the data to test whether this works and to predict 10-50 year equity premiums. And it is for the very-far-away expected cash flows where corporate finance managers are most in need of equity premium estimates. Therefore, most managers can neglect these regressions.

Method 4. Philosophy

Introspection and philosophy.

The fourth method is to wonder how much rate of return is required to entice reasonable investors to be indifferent between stocks and bonds. Even with an equity premium as low as 3%, over 25 years, an equity investor would end up with more than twice the money of a bond investor. Naturally, in a perfect market, nothing should come for free, and the reward for risk-taking should be just about fair. Therefore, equity premiums of 6-8% just seem too high for the amount of risk observed in the stock market. This philosophical method generally suggests reasonable equity premiums of about **1%** to **3%**.

Method 5. Surveys: Ask the Experts

Just ask!

What to choose? Welcome to the club! No one knows the true equity premium. So, the fifth method is to ask the experts—or anyone else who may *or may not* know. It's the blind leading the blind. The ranges of estimates have varied widely (and they are often also conveniently tilted in the interest of those giving them):

Analysts' estimates are all over the map, too. Estimates between 2% and 6% per annum seem reasonable.

- The Social Security Administration sometimes uses an estimate of around 4%.
- For decades, the consulting firm McKinsey has used a standard of around 5%.
- Around the turn of the millennium, the most common equity premium estimates recommended by professors of finance were **5%** for a 1-year horizon and **6%** for a 30-year horizon, both with a range from 3% to 8%. The estimates were generally similar in the United States, Spain, Germany, and the United Kingdom.
- On Monday, February 28, 2005, Jason Zweig of *The Wall Street Journal* reported some *after-inflation* forecasts from then to 2050 (per annum), as in Exhibit 9.3.

  As you already know, it matters (a) whether you quote geometric or arithmetic averages; and (b) whether you quote the equity premium with respect to a short-term or a long-term interest rate. If you want to use the short rate, then you need to add another 1-2% to the equity-premium estimates in this table. (Unrelated, for the equity premium, it does

Name	Organization	Government Stocks	Bonds	Corp. Bonds	Equity Premium Rel Gov	Rel Corp
William Dudley	Goldman Sachs	5.0%	2.0%	2.5%	3.0%	2.5%
Jeremy Siegel	Wharton	6.0%	1.8%	2.3%	4.2%	3.7%
David Rosenberg	Merrill Lynch	4.0%	3.0%	4.0%	1.0%	0.0%
Ethan Harris	Lehman Brothers	4.0%	3.5%	2.5%	0.5%	1.5%
Robert Shiller	Yale	4.6%	2.2%	2.7%	2.4%	1.9%
Robert LaVorgna	Deutsche Bank	6.5%	4.0%	5.0%	2.5%	1.5%
Parul Jain	Nomura	4.5%	3.5%	4.0%	1.0%	0.5%
John Lonski	Moody's	4.0%	2.0%	3.0%	2.0%	1.0%
David Malpass	Bear Stearns	5.5%	3.5%	4.3%	2.0%	1.2%
Jim Glassman	JP Morgan	4.0%	2.5%	3.5%	1.5%	0.5%
				Arithmetic Average (Difference):	2.0%	1.4%
				Volatility-Adjusted Geometric Average ≈ –1% :	1.0%	0.4%

Exhibit 9.3: *Jason Zweig Survey.* Some prominent equity analysts predicting.

not matter whether equity premium numbers are inflation-adjusted. Inflation cancels out, because the equity premium is itself a difference in nominal rates.)

We still have another 35 years to go before we can check the forecast, but 1-2% still looks right on the money.

- In 2005, still fairly soon after the bear markets of the early 2000s, a poll by Graham and Harvey (from Duke) and *CFO Magazine* reported an average equity premium estimate of CFOs of around 3%. By 2015, having experienced many years of bull market, Graham and Harvey reported that they then expected a 10-year relative equity premium of 4.5%.
- In mid-2008, just after the financial crisis, Merrill Lynch's survey of 300 institutional investors reported 3%.
- In 2012, Pablo Fernandez reported that analysts and companies in the United States, Spain, Germany and the United Kingdom all used average estimates of between 5% and 6%—just like finance professors, and with the same typical range from about 3% to 8%. And this estimate further increased by another 1% over the following 3 years. ➤ Pablo F., Exhibit 9.1, Pg.200.
- In 2017, the directors of the $299 billion(!) CalPERS pension fund will have to decide again whether their expected (geometric) rate of return of 7.5%—5% above the prevailing Treasury long bond—is optimistic. CalPERS also holds some non-public assets, but there is no reason to believe these assets are likely to outperform the stock market, either. If 7.5% seems unrealistic to you, it obviously is. But lowering this estimate would mean that California's politicians would have to set aside more money for their unfunded pension obligations *today*. Obviously, they would prefer to leave the optimistic estimate as is, and kick the can down the line to their successors.

  Thousands of other public employees pension funds all over the nations—and you younger taxpayers—face similar problems. Moody's estimates that politics has left public pension funds underfunded by about $7 trillion as of 2016—or about $50,000 per U.S. household. (Add social security and medicare commitments, and you can triple this.) Start saving up!

Of course, these estimates were themselves likely based on the first four methods, and they occur in echo chambers—they are what analysts, companies, consultants, students, and professors have been reading in corporate finance textbooks (like this one) for many years now. (Hmm...maybe I should try claiming 42.321% and then see how many surveyees will repeat it back in ten years.)

One aspect that does not make sense and that was already mentioned is that survey estimates seem to correlate too strongly with very recent stock market returns. For example, in late 2000, right after a huge run-up in the stock market, surveys by *Fortune* or *Gallup/Paine Webber* had investors expecting equity premiums as high as 15% per year. (They were acutely disappointed: The stock market dropped by as much as 30% over the following two years. Maybe they just got the sign wrong?!)

6. Internal Cost of Capital (ICC) and Accounting Models

Ask and Use!

A hybrid method combining survey methods and analysis is the "Internal Cost of Capital." Basically, this method uses analysts' consensus projections about S&P 500 earnings (over the next few years) with a perpetuity model to back out a cost of capital that makes the S&P 500 price equal to the analysts' discounted future earnings. Because analyst estimates vary over the business cycle, researcher usually use the average of many ICCs over many years.

In the graphs

If you glance at Exhibit 9.2 again, you will note a small line marked "FF Imp Stocks," which comes from just such an attempt to convert analysts' earnings forecasts into an expected rate of return for the stock market. Until the mid-1980s, this geometric average was generally lower than the historical average performance, consistent with the view that the 20th century was the lucky American Century. However, more recently, it has agreed more with the historical expected rate of return in suggesting much higher expected stock market rates of return for the future. (And, as with historical estimates, different variants can give estimates with a much larger range, say, from 0% all the way to 7%.)

Accounting Models?

There are some accounting-based models that are based on similar principles and are often claimed by their proponents as panaceas—or at least as better alternatives. Alas, when I looked at some of these models with a more skeptical eye, I could not share their enthusiasm for three reasons. First, these models are too "boutique": each has been tweaked just a little here and there to make it look good on their data. Second, these models tended to work well in the first halves of their samples and not so well in the second halves. Third, if they really worked half as reliably as they are claimed to work, then investment funds should flock to them like flies. Many looked at them and they did not. This is not to say that no such model works—just that those that I investigated more did not hold up.

9.4 Forward-Looking Benchmarks

The two most important numbers.

The risk-free rate and the equity premium are the two most important numbers in economics and finance. If the risk-free rate is high, you should save more and consume less. If the equity premium is high, you should allocate more of your savings into diversified risky stocks and less into bonds. The previous section has taught you about how to view the historical data.

Forward not backward!

But you are probably not interested in *historical* performance for its own sake. You are probably interested in the *future* expected performance instead. (When you want to judge whether you will have to drive uphill or downhill, looking at the rearview mirror may be better than nothing, but it is not ideal.)

Lasciate ogne speranza, voi ch'intrate

➤ Neutralizing Market Exposure, Sect. 10.4, Pg.228.

So what is the appropriate forward-looking expected equity premium *today*? Sadly, no one can tell you the authoritative estimate. Such an authority does not exist. Everyone is guessing. Unfortunately, unless your project has no (market-risk) type of exposure, you usually have to take a stance. (I will explain in Section 10.4 how you can finesse this, but doing so will have its own drawbacks.) I failed to shield you from the estimation dilemma. I can only give you the considerations that you can contemplate when you are picking *your* estimates.

No help in sight.

If you are hoping I will rescue you in future chapters, by either giving you the correct numbers or telling you that you do not really need them to make decisions, I can't. Even more involved financial models, in particular the CAPM in the next chapter, ask *you* to provide the same estimates. They just help by informing you about the expected rate of return for projects *relative* to Treasuries and the stock market. Given *your* estimate of how much risky average stock market projects should earn relative to safe projects, plus the market-beta, the CAPM tells you the benchmark cost of capital for your projects. But unless your projects have zero exposure to stock-market-type risk, the models themselves require *you* to input your equity premium estimate.

➤ Betas, Pg.183.

It is all about relative pricing, not absolute pricing.

The need for good alternatives (benchmarks) is important to capital budgeting in corporations. They measure the opportunity cost of capital. But you also need them if you are an investor on the buying side. Like everybody else, you cannot let your limited knowledge stop you from making investment decisions. You do need to be your own judge: what are your prevailing (economy-wide) opportunities? Where do you want to place your money?

Term and Risk

Not exactly chopped liver.

I admit that I could not teach you the correct premium estimates. But I am not altogether useless, either. I can teach you at least how to avoid some basic errors. You have already read about one important aspect, albeit in the context of historical averages. Short-term and long-term projects should have different benchmarks. This insight is very important and you can get this right. So let's discuss it in more detail.

Term Premia in Bonds

The correct approach is obvious for risk-free projects. If your project is short-term, the correct benchmark is the rate of return on short-term bills, not long-term bonds. If your project is long-term, the correct benchmark is the rate of return on long-term bonds, not short-term bills.

Term Premia in Stock Returns and Equity Premia?

The correct approach is less obvious for risky projects. Remember that stocks are themselves long-term cash-flow assets (even if you can sell them instantly, just as you can sell Treasury bonds at any moment).

➤ Stocks = Long-Term Asset, Pg.202.

- If you have a project with a payoff that is as risky as the stock market and with a similarly long horizon, the stock market is your correct benchmark. The stock market's expected rate of return reflects both the term and the risk premium. If you think that the last 50 years are a good representation for the future, Exhibit 9.2 tells you that you should expect a 10% average geometric rate of return, of which about 5% is the short-term benchmark (the premium for saving money), 2% is the premium for the long-term nature of payoffs, and 3% is the premium for taking risk.
- If you have a project with a payoff that is as risky as the stock market payouts or earnings, but lasts for only one period, the equity premium without the term premium is your correct benchmark. Thus, a discount rate of 7% is more appropriate.

Some finance professors believe that you should use a higher risk premium (higher than 3%) for long-term cash flows—that is, more term premium in stocks than in Treasuries. But only the Treasury term premium is easy to measure. The jury is still out, and this extra "kicker" would likely be small.

Geometric or Arithmetic Cash Flows and Benchmarks?

Geometric vs. Arithmetic matters for shorter-term return averages applied on long-term cash flows.

How does the NPV formula work under uncertainty? Over one time period, a geometric average rate of return is the same as the arithmetic average rate of return. This arithmetic average rate of return was itself calculated as the compounded (geometric) average over many smaller time intervals. Now, commonly-published benchmark rates of return are usually quoted as *annual* or even shorter-term rates of return, not as, say, 30-year rates of return. You have to translate the shorter-term rate of return statistics you are given into the expected longer rate of return statistics you need.

Arithmetic Use = Wrong

Does it make sense to compare arithmetic average returns across long-term project cash flows with different volatilities? Would you rather invest for T years in a ($100) project with an average annual rate of return of 5% and a variance of 40% (twice the stock market), or in a project with an average rate of return of 2% and zero variance? Would you take the first type of project if the financial markets offered you the opportunity of the second? If you use the NPV formula on the arithmetic averages as

$$\text{(Wrong:)} \quad -\$100 + \frac{+\$100 \cdot (1+5\%)^T}{1+1.02^T} > 0$$

you would conclude that you should take the project. But this would be wrong.

The project will not average 5% per T, but –3% per T.

➤ Geometric vs. Arithmetic Returns and Extrapolation, Sect. 7.1, Pg.142.

The reason is that the expected rate of return over T periods $E((1+r)^T)$ is not $[1+E(r)]^T$. Geometric rates of return are smaller than arithmetic rates of return. (Remember: a rate of return of 50% followed by one of –50% leaves you with a –25% rate of return.) As you already know, if the distribution follows a normal bell curve, then the geometric rate of return is about half the variance squared less than the arithmetic rate of return. With the mean of 5% and variance of 40%, you should really expect to earn $5\% - 40\%^2/2 \approx -3\%$ per T in your project, whereas the financial-market benchmark projects offer +2% per T. For a long-term project, you would be better off declining.

Most expected cash flows are implicitly geometric.

For long-term cash flows, NPV really makes sense only if you use the appropriately compounded, i.e., geometric, expected rates of returns. Fortunately, most investors think of the expected cash flows in the NPV numerator in geometric terms, because this is what they care about. If they use a –$100 flow today and a $150 flow in 10 years, they implicitly mean that they expect a compound rate of return of 50%, which they want to compare to geometric opportunity rates of return in the financial market elsewhere.

Term and Averaging

What do you expect as a rate of return on the stock market benchmark? If you expect the stock market to deliver 12% over the next year, with a 20% standard deviation, you should expect it to deliver about $12\% - 20\%^2/2 \approx 10\%$ over the very long run. The 2% difference is roughly the historical difference between arithmetic and geometric rates of return on the U.S. stock market over the last 50 years.

Now put together your knowledge of the term premium and risk premium when you want to benchmark your own either short-term or long-term risky cash flows. For a long-term project, you could invest either in the stock market or in Treasury bonds. As an investor, how much would you expect to earn above the stock market?

IMPORTANT

Whatever your base estimate is of the short-term market-risk premium EQPST ("equity premium, short term estimate"), the following rough adjustment is required to keep your estimate of the long-term market-risk premium consistent with your short-term market-risk premium estimate (assuming that the risk-reward tradeoffs will remain similar over the next few decades):

	Arithmetic	Geometric
Relative to Short-Term Bills	EQPST	≈ EQPST–2%
Relative to Long-Term Bonds	≈ EQPST–2%	≈ EQPST–3.5%

For example, if you believe that the stock market will outperform Treasury bills by 6% over the next one year, you should expect the stock market to outperform Treasury bonds by a (compound) ≈2-3% over the next 30 years. One can quibble whether these adjustment recommendations are off by up to 1%, but they are in the right ballpark.

Are you in the right corner?

When you evaluate short-term market-risk-level projects, you can use your EQPST base estimate in the top left corner as a reasonable benchmark. When you evaluate long-term projects, you should use the estimate in the bottom right corner. Whatever else you do, do not make the mistake of thinking they should be the same.

100% stock market is unaffected. Others are.

The decomposition of the of the stock market return into a term premium and an equity premium matters for investments that are not 100% like stocks. For investing 100% in stocks, whatever term premium you add on one end is subtracted back from the other ($TP+(MRP-TP) = MRP$). For short-term investments, you can expect a high equity premium but a low term premium. For long-term investments, you can expect a low equity premium but a high term premium. But if you have other types of investment, e.g. one that is more like 50% stock and 50% bond, it matters ($TP + 0.5 \cdot (MRP - TP) \neq MRP$). This will become even clearer in the next chapter.

Fund managers should also expect different excess returns over different horizons.

Investors need to think about the same kind of adjustments. When evaluating stock investments, fund managers should add the equity premium estimate and the term premium estimate, too, to arrive at what they can expect. Expecting to earn 6% over short-term Treasuries over the next year is consistent with expecting to earn 2-3% over long-term Treasuries over the long run.

Real-world hurdle rates are often set higher.

Do not take the rules too literally. It is not unusual for managers to be more conservative for long-term projects and assess higher hurdle rates on them. This is more likely related to their uncertainty about their cash flows and to imperfect market premia than the proper assessment of long-term average rates of return of stock and bond investments. For example, a tax-exempt pension fund should not expect an investment in the U.S. stock market to outperform an investment in long-term Treasuries by more than 2% per annum over the years, even if it has the perspective that the stock market will outperform Treasury bills by 6% over the next year.

Incidentally, do you remember Exhibit 9.1? Some of the disagreements over estimates stem from the fact that textbooks can mean different things by "equity premium." The most common estimate is probably the highest estimate, the EQPST.

My Personal Opinions

My recommendation.

The choice of geometric vs. arithmetic and Treasury bills vs. bonds is determined by application and not by opinion. Many earlier textbooks fail to explain the difference, resulting in miscalculated costs of capital. However, the choice of a relevant historical sample to assess the future is, in the end, opinion. For me, I tend to believe that the last 50 years are more relevant than the last 100 years. Thus, I recommend an equity premium of about 2% for long-term cash flows—which is much lower than the 5% that would be touted in other books. *Yet*, I also emphasize that I then use the 10-year term premium, which is 2-4% higher than the 1-year term premium. In Chapter 11, we will also discuss imperfect market premiums which can often further increase my long-term cost-of-capital estimates.

Remain consistent across projects.

I also emphasize that it is important to *be consistent*. Do not use 3% for investing in one project and 8% for investing in another similar project. Being consistent can sometimes reduce your relative mistakes in choosing one project over another.

Liars, liars, pants on fire

Finally, be aware that managers often care less about the scientific merits of costs of capital estimates than they care about whether they want to take or not take a project—whether they want to exaggerate or belittle its value. "Expert" witnesses often cherry-pick estimates as low as 0% or as high as 8%, depending on the paying clients' desires. I often find these estimates less believable the further away they are from my own assessment and the further they violate the spirit of the correct term adjustment. And I find anything outside this 0% to 8% range just too tough to swallow.

Q 9.3. What are appropriate equity premium estimates? What are not? What kind of reasoning are you relying on?

9.5 Asset Costs of Capital vs. Equity Costs of Capital

Equity and asset costs of capital and project hurdle rates

It is important that you always distinguish between the **asset cost of capital** and **equity cost of capital**. Debt is always safer than the underlying project and equity is always riskier. Thus, equity should have a higher cost of capital than the assets.

Comparing levered and unlevered projects.

➤ Asset and equity betas, Formula 8.6, Pg.188.

Let's work a short example. Say that you can buy a retail mall at a price that suggests an expected rate of return of 6%. However, when you look at **REIT**s (real estate investment trusts, which are stock-like equity investments) of retail malls at YAHOO! FINANCE, you see that those seem to offer much higher expected rates of return, say 12%. Hands off? Not necessarily.

Levering and Unlevering

To compare the two investments, you have to take into account that REITs are typically already highly levered. It is easy to obtain a 50% mortgage on a retail mall. If an 80% mortgage has an expected rate of return of 4% per annum, then the asset cost of capital for the underlying REIT project is

$$\begin{array}{ccccccccc} \mathrm{E}(r_{\text{Mall}}) & = & 80\% & \cdot & (4\%) & + & 20\% & \cdot & 12\% \quad = 5.6\% \\ \mathrm{E}(r_{\text{Mall}}) & = & \left(\dfrac{\text{Debt value}}{\text{Firm value}}\right) & \cdot & \mathrm{E}(r_{\text{Mortgage}}) & + & \left(\dfrac{\text{Equity value}}{\text{Firm value}}\right) & \cdot & \mathrm{E}(r_{\text{REIT}}) \end{array}$$

The 6% mall looks like a great deal. This calculation is called **unlevering** the cost of capital. Alternatively, you could have calculated a **levered cost of capital** for your proposed mall, assuming you could obtain the same mortgage terms,

$$\begin{array}{ccccccccc} 6\% & = & 80\% & \cdot & (4\%) & + & 20\% & \cdot & x \\ \mathrm{E}(r_{\text{Mall}}) & = & \left(\dfrac{\text{Debt value}}{\text{Firm value}}\right) & \cdot & \mathrm{E}(r_{\text{Mortgage}}) & + & \left(\dfrac{\text{Equity value}}{\text{Firm value}}\right) & \cdot & \mathrm{E}(r_{\text{REIT}}) \end{array}$$

This suggests an expected rate of return of 14%.

9.6 Deconstructing Quoted Rates of Return

Reminder: Stated bond yields contain time and default premiums.

➤ Time and default premiums, Sect. 6.2, Pg.113.

Let's return to the subject of Section 6.2. You learned that in a perfect and risk-neutral world, stated rates of return consist of a time premium and a default premium. On average, the default premium would be zero, and the expected rate of return would just be the time premium. All same-timed payoffs offered the same expected rate of return.

We have the time and risk premiums.

In this chapter, when we assumed that stocks offer higher *expected* rates of return than bonds, we changed the assumptions. Expected return differences for same-timed assets only make sense if investors are risk-averse or if the world is imperfect. (Either of these two changes will do—and, incidentally, either could also contribute to higher yields for longer-term project cash flows.) Working forward, let's say that investors are risk-averse. Thus, the expected rate of return on stocks offers an extra **risk premium**.

$$\begin{array}{lcl} \text{Promised Rate of Return} & = & \text{Time Premium} + \text{Default Premium} + \text{Risk Premium} \\ \text{Actual Earned Rate} & = & \text{Time Premium} + \text{Default Realization} + \text{Risk Premium} \\ \text{Expected Rate of Return} & = & \text{Time Premium} + \text{Expected Risk Premium} \end{array}$$

Not yet default premium!

You need to be careful in distinguishing between the default premium and the risk premium. The default premium is zero, on average. Only the risk premium increases your expected rate of return in the long run. Unfortunately, the expected rate of return (or, equivalently, the risk premium) is never posted in the real world. It is always only the stated rate of return that is usually publicly posted.

Here is an example. Say you want to determine the PV of a corporate project or quasi-bond that is 75% like risk-free debt and 25% like equity. Assume that the risk-free rate of return is 2% per annum and that the expected rate of return on the market is $2\% + 4\% = 6\%$. Therefore, the expected rate of return on the quasi-bond should be

A specific bond example: First compute the price necessary to make you "even" relative to the Treasury if you are risk-neutral. This price is based on the time premium and the default premium.

$$E(r_{\text{Quasi-Bond}}) = 75\% \cdot 2\% + 25\% \cdot 6\% = 3\%$$

This takes care of the time premium and the risk premium. Now assume that this quasi-bond promises to deliver \$200 next year. The price of the bond is *not* $\$200/(1+3\%) \approx \$194.17$! To understand this, continue. I have not even yet told you how likely it is that the firm goes bankrupt and what happens if it does. For example, it could be the case that with a probability of 5%, the quasi-bond pays nothing. In this case, the expected payoff on the quasi-bond is $5\% \cdot \$0 + 95\% \cdot \$200 = \$190$. Its price should be

$$PV_{\text{Quasi-Bond}} = \frac{E(C_{\text{Quasi-Bond}})}{1 + E(r_{\text{Quasi-Bond}})} = \frac{\$190}{1+3\%} \approx \$184.47$$

Given this price, you can now compute the promised (or quoted) rate of return on this bond:

$$\frac{\$200 - \$184.47}{\$184.47} \approx 8.4\%$$

$$\frac{\text{Promised Cash Flow} - \text{PV}}{\text{PV}} = \text{Promised Rate of Return}$$

And you can now quantify the three components in this example. For this quasi-bond project, the time premium of money is 2% per annum—it is the rate of return that an equivalent-term Treasury offers. The specific risk premium is the extra 1% in the expected rate of return that this quasi-bond offers above the equivalent Treasury. And the rest, 5.4%, is the default premium. You do not expect to earn money from this default premium "on average." You earn it only if the bond does not default.

The risk premium is above and beyond the time and default premiums. On average, risky investments earn more than risk-free investments now.

$$8.4\% = 2\% + 1\% + 5.4\%$$

$$\text{Promised Interest Rate} = \text{Time Premium} + \text{Risk Premium} + \text{Default Premium}$$

In the real world, most of the premium that investment-grade corporate bonds quote above equivalent Treasuries is not due to the risk premium but more due to the default premium (and perhaps some other imperfect premiums discussed in later chapters). Corporate bonds simply won't always pay as much as they promise. However, for corporate projects and equity shares, the risk premium can be considerable.

IMPORTANT

Never forget:

- Your benchmarks should be thought of in terms of expected rates of return. If you use historical average returns, you usually assume that these averages are representative of expected rates of return.
- The expected return is not a stated (promised, quoted) return, because it does not include a default premium.
- The probability of default must be handled in the NPV numerator (through the expected cash flow), and not in the NPV denominator (through the expected rate of return).

9.7 Other Benchmarks and "The Method"

Other possible benchmarks—fixed income buckets.

Treasury bonds and stocks are not the only two benchmark assets that you can use. Depending on the project to be valued, managers often use other benchmarks, too. For example, instead of the risk-free Treasury, some corporate managers use bonds that are similar to what they can issue themselves—e.g., investment-grade or junk bonds, mortgage bonds, collateralized bonds, prime borrower bank financing, etc. In all these cases, it is important not to forget to consider that publicly quoted comparables always include default premia, and that your own firm will also have to offer default premia. This is so important that I will repeat the repeat: I beseech you never to confuse expected rates of return with promised rates of return. Just because a non-investment grade bond offers 2-5% above the risk-free rate does not mean that it expects to pay off 2-5% above the risk-free rate. Future defaults will erode the difference. Expected rates of return are much more alike.

Equity and other buckets.

Even within the small corporate segment of equity fund managers, there are many benchmarks: not just the S&P 500, but also **value-vs-growth** portfolios, **market-cap** portfolios, **momentum** portfolios, **profitability** portfolios, or industry portfolios. Some corporate managers can benchmark their expected rates of return to some underlying commodities. For example, the expected rate of return on Exxon can be closely linked to the price of oil. If the appropriate expected rate of return on oil is, say, 20%, then Exxon's oil storage operations should similarly yield an expected rate of return of 20%. Private equity, venture capital, and hedge funds often have their own set of benchmarks, too.

How do your projects measure up?

In principle, it always works the same way: as a corporate manager, first you assess the expected rate of return on some underlying benchmark portfolios. Then you assess the expected rates of return on your own internal investment opportunities. How similar are your projects and to which benchmark? Can your projects be viewed as combinations of your benchmarks? If your opportunities beat the publicly available alternatives in risk-reward, you should invest. Otherwise, you should return the funds to your investors..

Prices or expected rates of return?

Our method is essentially just comparing opportunities to the price at which your investors can buy them for elsewhere. This is also why such a model is called an **asset-pricing model**, even though the model is then phrased in terms of expected returns. Expected returns are *never* posted. Only prices are. But all the economic insights are one: "opportunities with similar characteristics—and in particular risk characteristics—should offer similar expected rates of return."

You must not offer a worse tradeoff

Again, let it sink in: as a corporate manager, you need an expected rate of return—an opportunity cost of capital—as the denominator in the NPV formula. If your project offers a lower expected return than what your investors can earn elsewhere in similarly risky projects, then you should not put your investors' money into your project but instead return their money to them. If your project offers more expected return, then you should go ahead and invest their money into your project.

Summary

This chapter covered the following major points:

- For each project cash flow, you need to estimate the expected rate of return on equivalent benchmark investments. This is the "opportunity cost of capital" that corporations can use as their costs of capital in the terms of the NPV formula.
- The most important benchmarks are the expected rate of return to low-risk assets (such as Treasury bonds) and to high-risk equity assets (such as the S&P 500).
- For r_F, you should use bonds that match the timing of your project's cash flows. Thus, cash flows farther in the future usually have higher opportunity costs

of capital.

- It is difficult to estimate the equity premium. There is no clear consensus on what it should be or how to estimate it best. Reasonable estimates for the equity premium ($E(r_M) - r_F$) can range from about 1%/year for long-term payoffs to 8%/year for short-term payoffs. Estimates of about 1-3% seem common for most long-term project cash flows.
- Investors care about geometric rates of return, not arithmetic rates of return. When projects have different risk, the two averages can be very different.
- The correct benchmarks adjust properly for term and risk, but when based on historical estimates require judgment about what historical sample period is most representative of the future.
- Both bond and stock benchmarks have expected rates of return that are due to a number of factors, first and foremost risk. So do other benchmark portfolios and assets. It does not have to be bonds and stocks. By choosing better benchmarks that are more similar to their own projects, managers can often obtain better estimates for their costs of capital.

Keywords

Answers

Q 9.1 Use the 1-year Treasury rate for the 1-year project, especially if the 1-year project produces most of its cash flows at the end of the year. If it produces constant cash flows throughout the year, a 6-month Treasury rate might be more appropriate. Because the 10-year project could have a duration of cash flows much shorter than 10 years, depending on use, you might choose a risk-free Treasury rate that is between 5 and 10 years. Of course, it would be even better if you match the individual project cash flows with individual Treasuries.

Q 9.2 The duration of this cash flow is around, or a little under, 5 years. Thus, a 5-year zero-coupon U.S. Treasury would be a reasonably good guess. You should not be using a 30-day or 30-year Treasury. A 10-year zero-coupon Treasury would be a better match for a project that yields cash only once at the end of 10 years. That is, for our project, which has cash flows each year for 10 years, the 10-year Treasury as a benchmark would have too much of its payments as principal repayment at the end of its 10-year term.

Q 9.3 An estimate between 1% and 8% per year is reasonable. Anything below 0% and above 10% would seem unreasonable to me. For reasoning, please see the different methods in the chapter.

End of Chapter Problems

Q 9.4. If your projects' expected rates of return cannot meet the expected rates of return for the benchmarks, then what should you do as the manager?

Q 9.5. In a perfect world, should you take *only* the projects with the highest NPV or *all* projects with positive NPV?

Q 9.6. Explain the basic schools of thought when it comes to equity premium estimation.

Q 9.7. If you do not want to estimate the equity premium, what are your alternatives to finding a cost-of-capital estimate?

Q 9.8. Explain in 200 words or less: What are reasonable guesstimates for the market risk premium and why?

Q 9.9. Is the equity cost of capital usually higher or lower than the asset cost of capital?

Q 9.10. Assume that a comparable peer project in the financial market is financed by 50% debt and 50% equity. Its equity has an expected rate of return of 15%, its debt an expected rate of return of 5%. If your project offers an expected rate of return of 12%, should you take or leave this project?

Q 9.11. A firm has an expected rate of return of 6%. Its debt trades for the risk-free interest rate of 3%. The prevailing equity premium is 4%.

1. If the expected rate of return on the firm's equity is 7%, what is the firm's debt ratio?
2. The firm refinances itself. It repurchases one-third of its stock with debt that it issues. Assume that this debt is still risk-free. What is its new debt ratio?
3. What expected rate of return does the firm have to offer to its new *creditors*?
4. Has the firm's weighted average cost of capital changed?
5. What expected rate of return does the firm have to offer to its new *levered equity holders*?

Q 9.12. A Fortune 100 firm is financed with $15 billion in debt and $5 billion in equity. If this firm holds its underlying structure constant, would you expect the cost of capital on its equity to be higher or lower if the firm restructured its funding by repurchasing shares financed with new debt?

Data and Programming for Masters Students

Task A: Repeat Exhibit 9.2, but for the UK, Germany, and Japan, and only for the most recent 50 years. Omit series that you cannot find.

Task B: Write a program that shows that the long-term geometric rate of return can be approximated by the arithmetic rate of return minus half the the variance. For what kind of random distribution draws does this seem to hold better? Try a normal distribution, a log-normal distribution, and a binomial distribution.