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Additional Considerations in Estimating the Cost of Capital

Recapping the Cost of Capital

How should corporate management think about the cost of capital for a project or venture under consideration? How important is it to managerial decision making? How reliable is the cost of capital estimate? What impact has academia had on corporate management in calculating the cost of capital?

The key consideration has to do with the financial opportunities available to the corporation's investors. Assume its investors can invest in projects or companies with comparable risk to that of the project under consideration. If so, the expected return on these projects with equivalent risk is the correct discount rate that managers should employ in evaluating the project they are considering. In an economics framework, opportunity cost matters. But how do managers determine what a project with equivalent risk is? And once management identifies such a project, how do they go about figuring out what the expected return for the equivalent project will be?

Before the 1970s, corporations tended to employ an accounting rate of return or a simple payback-period technique to guide them in project valuation. But as the practice of modern finance evolved, thanks in part to financial theory developed in academia, such as the development of the capital asset pricing model (CAPM) and the subsequent work on unlevering equity betas (or risks), which bridged the gap between investments and corporate finance, large corporations began to embrace the use of net present value and internal rate of return in evaluating projects.

Based on the CAPM and the application of unlevering betas, the cost of capital for a project (or firm) is given by the formula:

Eq. 1 $$E(R_A) = R_F + \beta_A \left[E(R_m) - R_F \right]$$

Note that I have used "A" in the subscript to signify asset. Alternatively, I could have used "P" for project, but "P" is typically used to signify *portfolio*. Also, I prefer "A" as the reference to asset since our focus is on valuing projects on the left-hand side of the balance sheet. That is, for project valuation, we are not interested in the equity risk, per se; instead, we estimate the equity risk and unlever the equity beta to obtain the asset risk, that is, the asset beta.

In some cases, the project is simply an extension of the firm itself. Suppose Planet Fitness, a large chain of physical fitness centers, decides to increase its number of locations across the country from 2,045 to 2,500. In this instance, management of Planet Fitness can use its own asset beta, as well as asset betas of other pure-play fitness companies, in calculating the discount rate.

In many cases, the project under consideration will not have a systematic risk equal that of the overall corporation. For example, if Walmart decides to acquire Humana, the correct discount rate is the cost of capital of managed health-care companies, rather than the cost of capital of discount retailers. Likewise, consider a private equity firm such as Bain Capital, which invests in a broad spectrum of firms across many industries. Although Bain Capital is private, and most of its portfolio companies are privately held, management can still rely on stock returns data from publicly traded firms with equivalent risk to provide estimates for cost of capital calculations for the companies in Bain's portfolio.

In practice, we use stock returns to calculate equity betas and then unlever the equity betas to obtain asset betas. If debt securities were liquid and frequently traded, we would estimate both debt and equity betas, rather than calculate equity betas alone, and then take a weighted average of the debt and equity betas. Because debt securities are not usually liquid and frequently traded, we make a simplifying assumption about debt betas, often assuming they are at zero, or a low estimate such as 0.10 or 0.20. On the other hand, a corporation in or near financial distress would see debt betas far higher, perhaps even approaching 1.0 or more.[1]

There are three primary components of the cost of capital estimate using the CAPM, only one of which we have a high degree of certainty about on a forecasted basis -- namely the risk-free rate.[2] Considerable uncertainty exists about the market risk premium. For example, the standard deviation associated with the historical excess return of the overall stock market is roughly 20%. And equity beta estimates are subject to estimation error, as the distribution of stock returns can be highly skewed by various events over the estimation period, and thus can generate a misleading estimate of the true beta. In addition, there is the matter of estimation errors in attempting to pick comparable firms and periods from which to compute the beta estimates. Thus, estimates of cost of capital are extremely noisy – equity prices may deviate from their equilibrium values. But that is also true for estimating expected future cash flows. Nonetheless, deriving such estimates are critical to improving managerial decisions as to whether to invest in a project. And even if the estimates are quite volatile, that information can be useful in determining whether to move forward with a project. For example, we will be more likely to move forward on a project with +NPV if we have more reliability in the cost of capital estimate.

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[1] Granted, management of financially distressed firms are not focused on calculating asset betas with respect to project opportunities, rather are just attempting to live to fight another day.

[2] The resulting cost of capital estimate for a project or firm may go out to several significant digits on an Excel spreadsheet, thus falsely indicating a high degree of accuracy, yet typically will be estimated with substantial error. Even our proxy for the risk-free rate, short-dated U.S. Treasury bills, are not truly risk-free as they are subject to unexpected short-term inflation shocks, albeit with low probability.

Additional Considerations with Computing the Cost of Capital

There are a few additional considerations in computing the cost of capital. First, how should we think about the risk-free rate for long-term projects versus short-term projects? Second, in practice, how do managers employ the weighted-average-cost of capital (WACC)? Third, is the CAPM the right model by which to calculate the cost of capital? Or should we consider a multi-factor asset pricing model instead? We will discuss these considerations below.

Risk-Free Rate for Long-Term Projects

As discussed in the *Cost of Capital* lecture, the CAPM is a one-period model, and the risk-free rate is assumed to be a short-term Treasury security, in a well-developed economy. But most corporate projects are long-term in nature. As a matter of practice, investment bankers, private equity analysts, CFOs, etc., use the long-term Treasury rate as the measure of the risk-free rate. And rather than calculating a market risk premium of stocks relative to Treasury bills, they calculate a market risk premium of stocks relative to Treasury bonds, as we did in the Northrop Grumman example in the *Cost of Capital* lecture.

In the cost of capital formula, we can use the short-term Treasury bill as the risk-free security, even for long-term projects, which allows us to use the market risk premium of stocks relative to Treasury bills. But this approach requires us to forecast the expected treasury-bill return over the life of the long-term project. There are arguments that investors should be compensated for holding long-term Treasury bonds versus Treasury bills, due to the higher volatility, and the risk of inflation associated with Treasury bonds. Treasury bonds have outperformed Treasury bills by 1.6% annually and are three times more volatile, consistent with the argument that investors require a risk premium for holding Treasury bonds rather than Treasury bills.

That is why if one uses the Treasury bill as the risk-free measure in a long-term project, one needs to estimate the expected Treasury bill return over the life of the project:

Eq. 2 Expected Treasury Bill Return = Treasury Bond Return – Treasury Bond Risk Premium

For example, the current U.S. Treasury Bond yield is 3.9%. Assuming the historical difference of 1.6% in returns between Treasury bonds and Treasury bills, our best estimate of the Treasury bond risk premium going forward, as seen in Equation 2, yields an expected Treasury bill return of 2.3% over the next 30 years. Once the future risk-free rate has been estimated, Equation 1 should be modified by adding the expected operator in front of the risk-free rate as shown below in Equation 3:

Eq. 3 $$E(R_A) = E(R_F) + \beta_A\left[E(R_m) - E(R_F)\right]$$

While Equation 3 is more theoretically correct per the CAPM, it also adds the potential for measurement error to the cost of capital estimate. That is, we now also must estimate a bond risk premium, which may or may not be equal to the difference in the historical return between bonds and bills. We indicated in the *Cost of Capital* lecture that survivorship bias can partly explain the large excess historical returns of stocks over Treasury bills; the same is true of Treasury bonds over Treasury bills. I have rarely seen this version of the cost of capital used in practice, and I would consider it to be more of an academic exercise. But it is still useful to understand. In the end, the cost of capital calculation yields roughly the same answer if we are using the short rate versus the long rate. The most important thing to keep in mind is that the duration of the risk-free security should be the same for both places in Equations 1 and 3.

Weighted-Average Cost of Capital

The weighted-average cost of capital (WACC) computes the cost of capital for the overall corporation as a weighted average of the debt cost of capital and the equity cost of capital:

Eq. 4

$$R_A = WACC = R_D\left(1 - T_C\right)\left[\frac{D}{\left(D + E\right)}\right] + R_E\left[\frac{E}{\left(D + E\right)}\right]$$

Note, the WACC formula accounts for the after-tax cost of debt, because interest is a tax-deductible expense. It represents the concept that when one considers the cost of capital for a corporation, the focus is on the overall business risk, not just the risk of debt or of equity.

Many practitioners use the WACC as the cost of capital for projects of all types. However, the WACC works correctly and best under certain circumstances.[3] For example, the WACC assumes the project will have the same risk as that of the overall corporation, which is often not the case. Also, the WACC assumes the project will not alter the capital structure of the corporation. And moreover, that the capital structure will not change, for any reason. It assumes the same capital structure going forward. These assumptions are restrictive, and not necessary.

In the U.S., debt financing creates shareholder value since interest, while a return of capital to debtholders, is treated as an expense by the tax authorities. WACC reflects the after-tax cost of debt to account for the value creation resulting from the interest tax shields. And when using the WACC as the discount rate for a project under consideration by the firm, the resulting NPV reflects the tax benefits of debt financing. The NPV can be positive solely due to the use of the lower discount rate, via the WACC, as opposed to a discount rate which doesn't incorporate the interest tax shields. In the lecture, *The Tradeoff Theory of Capital Structure*, we introduce the concept of Adjusted Net Present Value, or APV, where we calculate separately the NPV of any financing benefits (or costs), such as interest tax shields, from that of the NPV associated with the project as if it were equity financed and without any market imperfections.

[3] I occasionally reference how practitioners make decisions and then point out the inconsistencies with how such decisions should be made. This is not intended to portray certain practitioners as acting irrationally, etc., rather, I believe for the most part that rational behavior prevails, but that we all operate in a world in which market frictions exists such that we end up taking short cuts. The use of WACC as the discount rate for all projects undertaken by a firm is one such short-cut, likely optimal in most instances.

Failure of the CAPM

The CAPM is a significant contribution to modern finance theory. It has not merely had an enormous impact in academia, but also a huge influence in the practice of finance. In practice, CAPM has been effective in estimating not just security or portfolio performance, but also in estimating the cost of capital for a project or an entire corporation.

Each CAPM investor holds the same efficient portfolio of risky assets. And if all investors choose optimally to hold the same efficient portfolio, then the market portfolio of all assets is the efficient portfolio, according to the CAPM. Based on their risk preferences, investors will hold some combination of the market portfolio and the risk-free security on the capital market line. That is, some investors will keep a high proportion of their portfolio in the risk-free security, and a low proportion in the market portfolio of risky assets. Other investors may choose to have no exposure to the risk-free security and simply hold the market portfolio. And some investors may even decide to lever up the market portfolio by borrowing at the risk-free rate. But in a CAPM world, all investors, regardless of their risk preferences, will hold some combination of the market portfolio and the risk-free security.

We can then use the CAPM to determine the expected return of any security or any portfolio of securities. The expected return on any given security, given the CAPM, is:

Eq. 5

$$E(R_S) = R_F + \beta_S\left[E(R_m) - R_F\right]$$

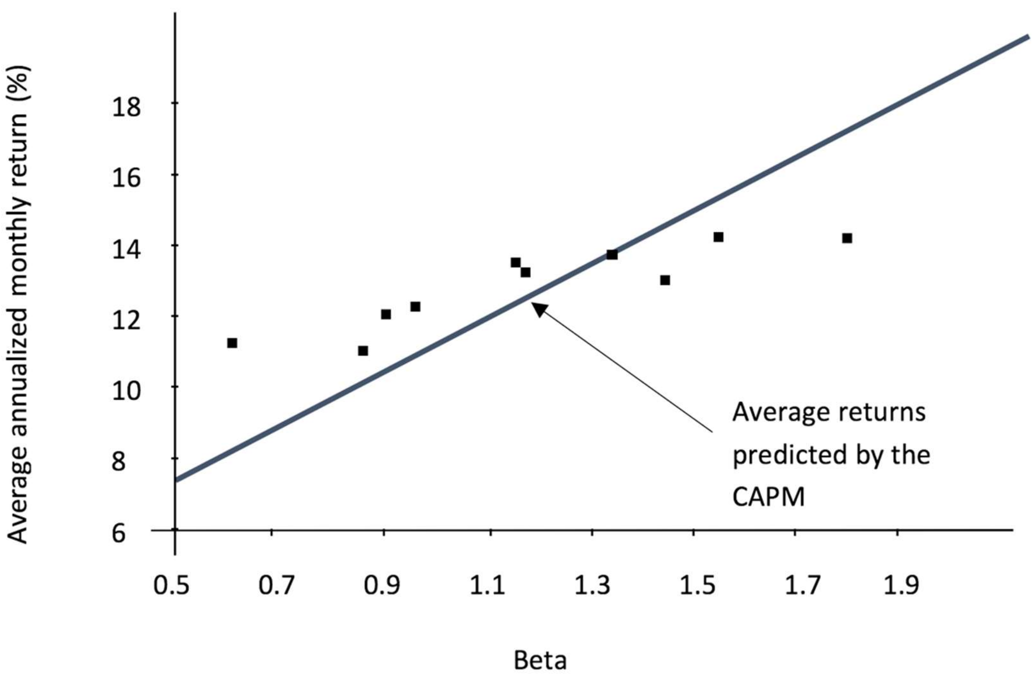
The notation above applies to any security, as the CAPM was developed not only to determine the expected return for equities, but rather for all securities. Since investors can diversify away all idiosyncratic risk, they are left with systematic market risk, or beta. Given the formula, there is a linear relation between the beta of a security and the expected return on the security. In the context of the cost of capital for a particular project, where the higher the beta, the higher the expected return, there is a higher the cost of capital for the project. For example, suppose Alphabet's expected annual return over the next several years is 10.7% based on the CAPM. Let's assume that the expected return on other firms with the same beta as Alphabet also have an expected return of 10.7%. If management of Alphabet is considering a project with the same risk as the overall firm -- say, a CAPX expansion across the board to grow the company -- the *hurdle rate* for the project (the minimum rate of return to move ahead with the project) is the expected return of 10.7%. Projects which have an IRR greater than or less than 10.7% create (or destroy) shareholder wealth.

Is the CAPM a suitable model by which we can reliably estimate the cost of capital for projects in our corporate finance setting? For example, we know that the assumptions don't fully explain investors' behavior. While in aggregate, investors hold the market portfolio, there are widespread deviations across investors. Look at Elon Musk, who has a net worth of over $200 billion in 2023, most of which is held in Tesla stock. At the other end of the extreme, many small investors tend to hold their favorite stock picks rather than the diversified market portfolio. Likewise, there is widespread empirical evidence that many investors, particularly individual investors, who don't always behave rationally. It is difficult to profit on these trades, especially after accounting for trading costs and management fees.

Empirical tests of the CAPM have generally created portfolios of stocks based on betas calculated from a prior period. According to the CAPM, these portfolios, ranked on beta, should line up on the security market line (the graph representing the CAPM). In a 2004 review paper, Fama and French update this basic relationship. It is reproduced here as Figure 1.[4] The relationship between beta and average returns for ten portfolios sorted on beta have a lower slope than that implied by the CAPM. That is, as illustrated in Figure 1, the returns are higher than predicted for low-beta portfolios and are smaller than predicted for the high-beta portfolio.[5] Note that the relation is still linear and positive, but with a lower slope than that predicted by the CAPM.

Figure 1

Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on Prior Beta, 1928-2003



Given the CAPM doesn't appear to explain stock returns fully, the implication is that other factors, in addition to the market return, may help to explain this. Since the development of the CAPM, empirical researchers have shown that specific portfolios of stocks have higher beta-adjusted returns than the market portfolio. For example, while small stocks have higher betas than large stocks, their realized returns are statistically higher, even after adjusting for their higher betas. This phenomenon is the well-

[4] Eugene Fama and Kenneth French, "The Capital Asset Pricing Model: Theory and Evidence," *Journal of Economic Perspectives* 2004. Figure 1 above is reproduced from their Figure 2 on page 33.
[5] Only the return for the seventh decile beta portfolio lands exactly on the security market line.

known size effect. Another example has to do with value stocks represented by firms with high book-to-market ratios. Value stocks tend to have positive excess returns after accounting for their beta loading on the overall portfolio. Likewise, stocks which have performed well tend to continue to perform well, a phenomenon referred to as *momentum*. Overall, these results, and similar other results, are not consistent with the CAPM, namely that the market portfolio is the efficient portfolio.

The evidence that certain "style" portfolios of stocks do better or worse than as the market portfolio predicted by the CAPM is consistent with the concept of a multi-factor asset pricing model, rather than the CAPM, in which only the market is a factor. The original theory behind the idea of a multi-factor asset pricing is the Arbitrage Pricing Theory (APT) developed by Stephen Ross.[6] According to the APT, the return of a security is a function of numerous factors, as opposed to just the market portfolio in the CAPM. Think of the CAPM as one example of the APT, although a more restricted one.

The most influential empirical multi-factor asset pricing model is the Fama and French three-factor asset pricing model developed in 1993.[7] It is based on prior empirical research during the 1980s which documented that small stocks and high book-to-market stocks realized positive beta-adjusted returns. Fama and French created a three-factor model, including a size factor and a book-to-market factor, in addition to the factor of the overall market. The formula for the Fama-French model is:

Eq. 6
$$E\left(R_E\right) = R_F + \beta_E\left[E\left(R_m\right) - R_F\right] + \beta_{SMB}SMB + \beta_{HML}HML$$

Again, in the Fama and French model, the market is but one of the model's three factors. It is shown here as the expected market return minus the risk-free rate. The second factor in the equation is the size factor -- the return on small stocks minus the return on large stocks. The third factor is the value factor -- the return on high book-to-market stocks minus the return on low book-to-market stocks. Fama and French found that the three-factor model as described above does a better job of explaining the performance of stock returns than the single-factor CAPM, where only the market beta matters.

Just as the market factor has a risk premium, as discussed in the *Cost of Capital* lecture, the other two Fama and French factors have risk premiums as well. For example, the higher return to small stocks reflects the fact that small stocks have higher risks associated with them than large stocks. Arguably, small stocks are more sensitive to changes in business conditions; while they may have higher market betas to reflect this, they still bear an additional risk premium per the three-factor model. And Fama and French note that high book-to-market stocks may be more susceptible to financial default risk, which is not fully captured by the beta on the market risk premium. If one observes that small stocks or value stocks perform well in a CAPM world, that is, generating positive alphas, this finding suggests market inefficiencies, given the model. The Fama and French response is that the single market factor in the CAPM is not sufficient to fully explain returns, and thus other risk factors must be included, as well.

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[6] Ross, Stephen, "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 1976.
[7] Fama, Eugene and Kenneth French, "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics* 1993.

Below, we apply the Fama and French three-factor model to illustrate how a multi-factor model can be implemented to compute the cost of capital for a project. Note that numerous multi-factor models have emerged in the past few years, though the Fama-French model remains at the forefront. For our purposes, we can apply the following exercise with any respected multi-factor model, without taking a stand *per se* on one model versus another.

Consider McDonald's Corporation, the global leader in fast food franchises. We can compute the short-term cost of equity capital for McDonald's using the CAPM and the Fama-French three-factor model. Monthly returns for a recent five-year period (October 2013-September 2018) are employed to compute regression estimates. The returns for McDonald's are taken from Bloomberg, and the returns for the market and the two additional Fama-French factors are available from Ken French's website at Dartmouth University.[8] The market return is a value-weighted return of all NYSE/AMEX/NASDAQ firms and is net of the U.S. Treasury bill return. Likewise, the return for McDonald's stock is also computed net of the U.S. Treasury bill return for the regression. SMB (Small minus Big) uses the return of small-stock portfolios, minus the return of large-stock portfolios, to capture the size effect. HML (High minus Low) uses the return of value-stock portfolios, minus the return of growth-stock portfolios, to capture the book-to-market effect.

Table 1 displays the CAPM regression. The beta estimate is 0.594, well below 1.0, likely due to the fast food industry being somewhat recession resilient, as opposed to more expensive dining establishments such as Le Bernadin in New York City or Noma in Copenhagen.[9] Note that while McDonald's is a large multinational corporation, the explanatory power of the overall stock market can only account for 17 percent of the variation in McDonald's stock price returns. That is, most of the variation in the returns to McDonald's stock is driven by idiosyncratic risk, as opposed to systematic risk.

Table 1
CAPM Regression Estimates for McDonald's Corporation

R Square	0.171					
Observations	60					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Alpha	0.006	0.005	1.167	0.248	-0.004	0.016
Market Beta	0.594	0.164	3.626	0.001	0.266	0.922

While this course is not about statistics, it is helpful to understand the basic statistics from the regression output, as they can influence managerial decision making. The only number included from the above regression statistics which ends up in in the cost of capital calculation is the beta coefficient of 0.594. The other numbers are often disregarded but can be relevant. The standard error, 0.164, is the estimate of the variability associated with the 0.594 beta coefficient. The t-statistic measures how significant the beta

[8] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/. Go to the Data Library on Ken's page where there is a wealth of factor returns information.

[9] I prefer Wendy's since it offers Diet Dr. Pepper.

coefficient of 0.594 is from zero. Given the t-statistic is 3.63, the coefficient is statisically different from zero.[10] And the p-value provides the probability levels associated with this beta coefficient and its difference from zero. But we care more about the confidence intervals (the mean of the estimate, plus or minus the variation in the estimate) associated with the beta coefficient. The confidence intervals of 0.266 and 0.922 indicate that we can be 95 percent certain that the intervals of 0.266 and 0.922 contain the true mean. In other words, the range of believability is quite large. The *Cost of Capital* lecture cautions us as to the reliability of the market risk premium as it is just an estimate. The same is true of these beta coefficients, as they are only estimates with significant potential measurement error.

The next step is to evaluate McDonald's returns with the three-factor Fama-French model via regression analysis for the same five-year period. Table 2 displays the regression output.

Table 2

Fama French Regression Estimates for McDonald's Corporation

R Square	0.233					
Observations	60					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Alpha	0.005	0.005	1.040	0.303	-0.005	0.014
Market Beta	0.658	0.159	4.124	0.000	0.338	0.977
SMB Beta	-0.469	0.181	-2.584	0.012	-0.832	-0.105
HML Beta	0.067	0.190	0.355	0.724	-0.313	0.448

As seen above by the R-Square of 0.233, the Fama French regression has greater explanatory power than the CAPM regression with an R-Square of 0.171. Even so, the three-factor model explains less than one-fourth of the variation in the returns to McDonald's. The market beta increases from 0.594 to 0.658, suggesting that McDonald's stock has a higher relation to the overall stock market with the inclusion of other factors. The coefficient on SMB is -0.469 and thus a negative loading on the small-minus-big factor. This factor loading is not surprising, given that McDonald's has a market capitalization of nearly $140 billion, and therefore is a large capitalization stock that behaves as such. The coefficient on HML is 0.067 and indicates that McDonald's stock returns load positively on the value premium. But note that the standard error of 0.190 is large relative to the 0.067 estimate, and thus the confidence interval is also large on a comparable basis. Given McDonald's P/E ratio of roughly 23, it is not a deep-value stock with a low multiple; nor is it a high-growth stock. Consequently, the 0.067 seems within the expected ballpark, as the factor loading is not high in absolute value.

Remember that when we compute the risk premium for a project with the CAPM framework, we multiply the market beta associated with the project by the market risk premium, which we assume for our purposes is 6.5% for short-term projects.[11] To simplify, we focus only on the equity cost of capital here

[10] For example, a test statistic of 1.96 indicates significance at the 5% level.

[11] The *Cost of Capital* lecture considers only long-term projects and used a market risk premium of 5.6%.

and thus do not delever the firm's equity beta to obtain the asset beta. Using the CAPM framework, the equity cost of capital for McDonald's is:

Eq. 4a $$6.26\% = 2.4\% + 0.594 \times 6.5\%$$

That is, given the CAPM beta coefficient of 0.594 and the market risk premium of 6.5%, the expected cost of equity capital for McDonald's is 6.26%.[12] Thus, if investors subscribe to the CAPM, they expect to receive a return of 6.26% based on holding McDonald's stock. The same methodology applies to estimates of McDonald's equity cost of capital in the Fama-French model. The regression output supplies the beta coefficients or factor loadings, and we already have the market risk premium of 6.5%. Thus, the two missing inputs are the risk premiums on SMB and HML, respectively.

As discussed in the *Cost of Capital* lecture, we don't know the true market risk premium. Instead, we look to historical evidence of realized excess returns and calibrate relative to theoretical models. We also can consider current valuations and attempt to back out the market risk premium, but this also requires having the right estimate of the expected future growth rate which is an arduous task. In the end, our estimate is subject to substantial measurement error. Notwithstanding the issues with estimating the market risk premium, one can use economic arguments beginning with the case that stocks should outperform risk-free securities. And various theoretical models suggest how large this risk premium should be. But with risk factors such as SMB and HML, there are no widely accepted economic arguments and theoretical models which indicate, for example, by what magnitude small stocks should outperform large stocks. That is why we rely on the historical record to implement the model to estimate the equity cost of capital.

The Fama-French factors are available on Ken French's website at Dartmouth University. Below, I use the most recent fifty years of data, as the data from the first half of the 20th century is spotty and has numerous missing records. Table 3 displays the annual returns for each of the three Fama-French risk factors, including the market premium, over the 1968-2017 period.

Table 3
Summary Statistics for Fama-French Risk Factors

	Market - Risk-Free	Small – Big	High – Low
Average Annual Return	6.77%	2.00%	4.9%
Standard Deviation	17.84%	12.10%	14.30%
Standard Errors From Zero	2.68	1.17	2.43

The market is the return on the value-weighted index of all NYSE-AMEX-NASDAQ stocks, and the risk-free return is the return on short-term U.S. Treasury bills. The annual market return, net of the risk-free rate, over the past 50 years is 6.77%. Also, as discussed previously, the volatility of stocks is large relative to bonds, and is calculated at 17.84% for the past 50 years. Thus, there is a considerable amount of variability

[12] Note that the 2.4% represents the Treasury bill yield in 2018.

around the 6.77% excess return. Despite the high volatility, the mean estimate of 6.77% is 2.68 standard errors from zero and thus reliably different from zero.[13]

The difference in annual returns between small stocks and large stocks over the past 50 years is 2.00% and referred to as the small stock premium. This premium estimate, based on the past 50 years of data, is considerably smaller than the premium estimate for the overall stock market relative to Treasury bills. Indeed, at least for the past 50 years, the 2.00% excess return is not statistically different from zero -- it is only 1.17 standard errors different from zero. Value stocks, as proxied by high book-to-market ratios, generate annual returns which are 4.90% greater than growth stocks as proxied by low book-to-market ratios. The value premium, at least for the prior 50 years, appears to be reliably different from zero (2.43 standard errors from zero).

Now that we know the McDonald's factor loadings for the three-factor Fama-French model, we can multiply the factor loadings, that is, the regression beta coefficients, by the estimates for the three risk premiums to compute McDonald's equity cost of capital. It is:

$$\boxed{\text{Eq. 6a}} \quad 6.07\% = 2.40\% + 0.658\left(6.50\%\right) - 0.469\left(2.00\%\right) + 0.067\left(4.90\%\right)$$

Thus, according to the Fama-French three-factor model, the expected equity return, or equity cost of capital, for McDonald's stock is 6.07%, and thus roughly the same as the 6.26% equity cost of capital per the CAPM.[14] For many other firms, the Fama-French model will provide widely different estimates than the CAPM, as the factor loadings can be all over the place, especially for SMB and HML, at least at the individual firm level. At the industry level, the factor loadings are more stable, due to the averaging effects across numerous firms.

The Fama-French model, as well as other multi-factor asset-pricing models, is not as widely used as the CAPM in estimating the cost of capital for corporate projects. The multi-factor models require more beta estimates and more risk premium estimates. These can be computed, but they are more difficult to interpret and understand versus the beta in the CAPM framework. Moreover, as we noted for SMB for the recent 50-year record, its return is not statistically different from zero. Also, there is the matter of taking it on faith that factors such as SMB and HML are indeed genuine risk factors which are priced by investors. That is, one needs to be able to tell a story, for example, that value firms are riskier during market downturns, perhaps due to having high fixed costs and not being able to react quickly to negative shocks. In contrast, a growth company can defer its investment spending during a downturn. And it must be the case that the beta on the market doesn't capture this value loading -- that is, that one would expect value stocks would have higher stock market betas using this logic, but that is not the case given the empirical rejections of the CAPM. Alternatively, behavioral finance would suggest that SMB and HML are not risk factors; rather, they reflect a mispricing of securities attributed to inefficient markets.

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[13] Note the standard error of the mean is simply the standard deviation divided by the square root of n. Thus, 17.84% divided by the square root of 60.

[14] If the task were to calculate McDonald's cost of capital rather than the equity cost of capital, one would need to unlever the beta estimates in both models via McDonald's leverage ratio.

To summarize, the Fama-French three-factor model has had an enormous impact in finance, not only in academia, but in practice as well. It has done a great job in pointing out that the CAPM is not as reliable as an asset pricing model as once thought. Today, investment fund performance is generally measured relative to the multi-factor asset pricing model, if anything, to see what factors a fund's portfolio loads on. The concept of alpha, in a CAPM world, is no longer necessarily alpha in a multi-factor world. For corporate finance and calculating the cost of capital, the Fama-French model is a nice complement to the CAPM, but not an obvious or even suitable replacement. Indeed, at the project level, it is often confusing to think about how projects should load on SMB or HML. We can think of firms loading on these factors, rather than individual projects. As a practitioner, I have rarely seen anyone use a multi-factor model to calculate the cost of capital. But I think it is helpful to be able to do so, as it helps to confirm or modify our CAPM estimates and reinforces our belief that systematic risk matters more to investors than idiosyncratic risk.