**Cost of Capital**

**Learning Outcomes**

After completing this module, students will be able to:

1. Calculate the weighted average cost of capital using appropriate weights, correctly incorporating issuance costs, and applying a suitable adjustment for project risk.
2. Measure the costs of debt and equity capital using the capital asset pricing model, implied cost of capital, or treasury spread methods.
3. Determine a weighted marginal cost of capital for projects in new industries or multi-divisional organizations.
4. Decide on the appropriate risk-free rate and market risk premium in the capital asset pricing model.
5. Calculate a firm’s raw beta in the capital asset pricing model.
6. Demonstrate how the statistical quality of raw beta estimates can be improved using adjusted betas, industry and peer group betas, accounting betas, and unlevered and levered beta.
7. Explain how size premiums enhance the capital asset pricing model.
8. Estimate the cost of common equity using alternative methods including the build-up method, multi-stage implied cost of common equity, and Fama French 3-factor model.
9. Describe how the financial information provider Duff & Phelps aids businesses in calculating their cost of capital.
10. Critically assess the quality of all cost of capital estimates.

**Introduction**

Managers must be able to accurately estimate the cost of capital to value their own company, its different business units, or any potential acquisitions and to make wise capital budgeting decisions. Another name for the cost of capital is the required rate of return which is the return investors expect to earn to be fairly compensated for the risks they assume.

The cost of capital is difficult to measure accurately and small errors have a major impact on decision-making. Reliable market data is usually available for large, publicly-traded companies but not for smaller private firms. The cost of capital should reflect the risk of a new project but this may be different from a company’s current business. Many large corporations have several business segments or reporting units that operate in very different industries that need their own cost of capital. Researchers and practitioners have developed a variety of models to estimate the cost of capital but they are complex and unreliable and there is considerable disagreement about which ones provide the best results.

Given this dilemma, most companies do not calculate their cost of capital alone but instead rely on outside financial information providers to supply expert advice and the needed inputs. These information providers use a variety of approaches, so users must be able to critically assess them. Firms typically estimate their cost of capital in several different ways to verify their results and gain more confidence in their findings.

Despite these problems, firms know they must devote considerable resources to accurately determining their cost of capital. Rough guesses or rules of thumb are not acceptable given the impact this rate has on decision making.

* 1. **| Weighted Average Cost of Capital**

The value of a business equals the present value of the future after-tax cash flows that it expects to generate for investors. Businesses are valued from two perspectives:

**Firm.** This perspective includes all debt, preferred share, and common share investors. Interest paid to debt holders and dividends paid to preferred and common shareholders are not deducted when calculating the cash flows generated by the company.

**Equity.** This perspective includes only common shareholders. Interest and preferred share dividends are deducted but common share dividends are not deducted when calculating the cash flows generated by the company.

The weighted average cost of capital (WACC) is used to value a business from the firm’s perspective, while the cost of common equity, a component of WACC, is used to value a business from the equity perspective. For business valuation purposes, preferred equity is equivalent to debt as these investors do not vote, receive regular fixed interest and principal payments, and are usually not entitled to a portion of the firm’s residual income just like bondholders. The discount rate used to value a firm increases with the riskiness of its future cash flows.

Valuing a firm from the equity perspective is the most common as analysts are typically estimating the value of a company’s common shares. WACC is sometimes used in business valuation, but it is normally employed in capital budgeting where managers try to determine if a new project’s expected after-tax cash flows exceed the cost of its debt and equity financing. WACC is also used to evaluate managers to see if they are adding value for debt and equity investors by earning more than their required rate of return. Finally, oversight boards in regulated industries use WACC to set consumer prices so debt and equity investors only receive a fair return equal to their required rate of return.

The formula for WACC is:

(Wd) x (kd) + (Wp) x (kp) + (Wc) x (kc)

Wd – Weight of debt

Wp – Weight of preferred shares

Wc – Weight of common shares

kd – After-tax cost of debt

kp – Cost of preferred shares

kc – Cost of common shares

Small variations in the discount rate have a major impact on a firm’s valuation or a capital project’s profitability, so analysts put considerable energy into calculating WACC. Despite these efforts, there is still significant estimating error. Several factors contribute to this problem:

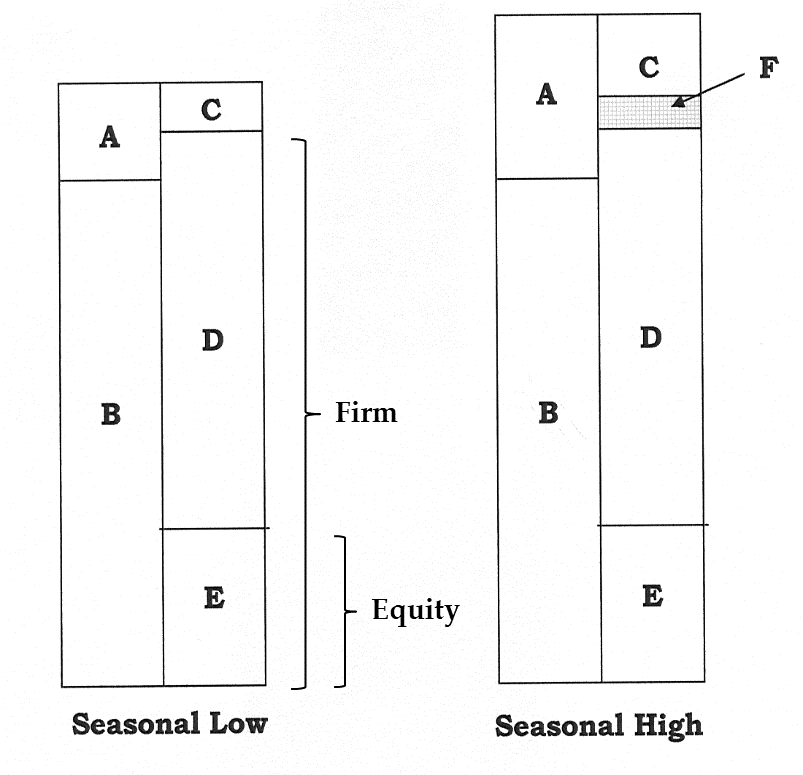
* Accurate financial information needed to calculate WACC is frequently not available especially for small public corporations and private firms.
* Analysts may only want to value part of a business like a subsidiary but most of the financial data available are for the entire firm.
* Techniques for calculating WACC are numerous and complex and there is considerable debate over which methods produce the most accurate results.
* Many models for calculating WACC are statistically unreliable.

To deal with these issues, analysts rely more on outside financial information providers to help determine WACC.

**Weighted Average Cost of Capital Weights**

WACC is the weighted average cost of the permanent debt and equity financing used to finance a firm’s long-term assets and long-term net working capital. Long-term net working capital is the level of working capital at the seasonal low. Since the amount of net working capital never falls below this amount, it should be financed with permanent debt and equity financing, so funding is always available. The current portion of any long-term liabilities is included in permanent debt even though it is classified as a current liability. Temporary financing should not be included in the calculation of WACC as it is used to finance seasonal variations in net working capital only.

**Exhibit 1: Capital Structure Components**



**A** – Current assets

**B** – Long-term assets

**C** – Current liabilities

**D** – Permanent debt financing

**E –** Permanent equity financing

**A – C** = Net working capital

**F** – Temporary financing

The cost of debt, cost of preferred shares, and cost of common shares components of WACC are weighted based on the book value or market value of a firm’s debt and equity or its target capital structure. The book value of debt and equity are readily available in a firm’s financial statements but the amounts vary considerably depending on the accounting policies adopted and are usually outdated. Book value weights are also not forward-looking, so they do not incorporate any planned changes in the firm’s capital structure.

Market values are up-to-date but they fluctuate significantly in the short-term due to up and down movements in the financial markets. They are also difficult to attain for private companies whose securities do not trade publicly. As more firms adopt fair value accounting under International Financial Reporting Standards (IFRS), differences between book and market value are becoming less pronounced. Stocks and bonds are also typically issued at different times depending on market conditions and in large amounts due to economies of scale for issuance costs. This causes debt and equity weights to vary considerably in the short term thus distorting a company’s WACC.

Target capital structure is the ratio of permanent debt to permanent equity financing that maximizes a firm’s value. Most companies know their target capital structure and try to maintain it over time. It balances the benefits of financial leverage with the safety of having more equity. Target capital structure is the preferred method for weighting the different costs of capital when calculating WACC as it is future-orientated, more stable, matches the long-term time horizon of most companies and capital projects, and can be calculated without a current share price. External analysts may have difficulty determining a firm’s target capital structure as managers are not required to disclose it publicly. Industry average debt levels, trends in actual capital structure, or statements by management may be used to approximate it.

Some companies do not know their target capital structure so using the market value of debt and equity to calculate WACC is the next best choice. Many firms use book value when market prices are not available. Module: Target Capital Structure examines how firms determine their target capital structure.

**Cost of Common Equity**

The cost of common equity is calculated using the capital asset pricing model (CAPM), implied cost of common equity, or treasury spread approach.

**CAPM.** This model states that:

kc = kf + Bc (km – kf)

kc – Cost of common equity

kf – Risk-free rate

Bc – Beta of the firm

km – Market rate

(km – kf) – Market risk premium

All investors expect to earn the risk-free rate plus the market risk premium (MRP) adjusted for the riskiness of the company as measured by its beta. The risk-free rate is the return investors expect to earn on riskless government bonds with a maturity that matches the time horizon of the company or the project being evaluated. Given the long life of most companies and projects, this is typically the 20-year or 30-year government bond rate.

The market rate is the return on a market portfolio of risky stocks that are only exposed to market risk. Market risk is the non-diversifiable risk due to inflation, interest movements, or the business cycle that affects all companies simultaneously and cannot be diversified away. The MRP is the extra return that investors expect to earn if they go from an investment in riskless government bonds to the market portfolio of risky stocks. The return on the market portfolio is determined using a broad-based, market value-weighted index that represents a large proportion of all stocks traded like the S&P 500 or the Russell 3000. Specialized or smaller indexes like the Dow 30, which is the 30 largest companies in the U.S., should not be used.

Beta measures the riskiness of a company’s stock relative to the market portfolio and is used to adjust the MRP to determine the appropriate return for an investment. B > 1.0 means the company moves together with the market portfolio but fluctuates more, B < 1.0 means the company moves together with the market portfolio but fluctuates less, and B = 1.0 means the company moves together with the market portfolio and fluctuates the same. B < 0.0 means the company and the market portfolio move in opposite directions.

**Implied cost of common equity.**  This model estimates the cost of common equity using the one-stage dividend discount model (DDM). The DDM formula is rearranged to isolate the cost of common equity.

kc = (D1 / P0) + gd

kc – Cost of common equity

D1 – Next year’s dividend

P0 – Current share price

gd – Growth rate of dividends

The cost of common equity is equal to the company’s dividends next year divided by its current share price, which is called the expected dividend yield, plus the growth rate of dividends. The growth rate of dividends can be estimated using the average historical dividend growth rate, analyst estimates of future earnings growth, or the sustainable growth rate. Estimated earnings growth rates are a proxy for dividend growth and are available from financial information providers for the next three to five years.

**Treasury spread.** The difference between a firm’s cost of common equity and the return on government bonds of the same maturity should be stable assuming there are no major changes in the company’s operations.

kc = kf + SpreadT

kc – Cost of common equity

kf – Risk-free rate

SpreadT – Treasury spread

The treasury spread will vary somewhat over the business cycle, but these changes will average out over the long-time horizon of most companies or capital projects. The spread typically falls in good economic times and rises during recessions as investors favor safer government securities as part of a “flight to quality” strategy. The spread is calculated using comparable companies with the same credit rating. For example, if a company has a B credit rating, other companies with a B rating trade at a 6.5% spread over the treasury rate, and the current long-term treasury rate is 5.0%, its cost of common equity is approximately 11.5%.

CAPM is the most commonly used method for determining the cost of common equity in practice. It is a theoretically sound model that, unlike the implied cost of common equity, adjusts for risk directly using beta and does not require that a company pay dividends or be able to calculate its dividend growth rate. The risk-free rate, MRP, and beta are difficult to estimate accurately though and small errors in these inputs dramatically affect the results. The use of the implied cost of common equity is in decline, but it is still employed to verify CAPM results or if a firm’s beta cannot be measured accurately.

Besides common shares, some firms have complex capital structures that include other types of equity such as stock options, warrants, rights, and conversion features on debt and preferred share issues. The costs of these securities are included in equity, but they normally represent a small portion of a firm’s total financing.

**Cost of Debt**

The cost of debt is calculated using either the implied cost of debt or treasury-spread.

**Implied cost of debt.** Using the yield-to-maturity formula, a firm inputs a bond’s current price, semi-annual interest coupon, the return of principal at maturity, and the number of interest payments and then solves for the implied cost of debt.

P0 = (I) (1 – (1 + kd)-n) / kd) + Principal / (1 + kd)n

kd after tax = (kd) (1 – t)

P0 – Current bond price

I – Interest coupon

kd – Cost of debt

n – Number of payments

t – Marginal tax rate

Interest, unlike dividends, is tax-deductible which reduces the after-cost of borrowing. A firm’s marginal tax is used to calculate the after-tax cost of debt. This is the tax rate on the firm’s last dollar of taxable income, but it may be different if rates are expected to change over the life of the company or project. Some provinces collect their corporate income taxes, so always include both the federal and provincial corporate tax rates. Expected future business losses or unused income tax loss carrybacks or carryforwards will reduce the marginal tax rate and raise the cost of borrowing. This after-tax cost of debt is calculated semi-annually as bond interest is usually calculated quarterly, so multiple this value by two to determine the annual rate.

**Treasury spread.** The treasury spread approach can be applied to bonds like it was to common equity.

kd = kf + SpreadT

kd after tax = (kd) (1-t)

kd – Cost of debt

kf – Risk-free rate

SpreadT – Treasury spread

If a bond price is not available, a firm’s cost of debt can be estimated using bonds of other companies with similar credit ratings, terms to maturity, collateral, subordination, and guarantees. These features should be similar as they affect the bond’s risk level and yield-to-maturity. If a firm does not have a formal credit rating, a synthetic credit rating can be estimated.

Instead of bonds, many companies use commercial loans and leases to finance their operations. Interest rates on recently negotiated lending agreements with the same maturity and similar features can be used to approximate the cost of debt. A firm will likely have more than one source of debt financing, so it should determine a weighted-average cost of debt using the market value of each issue.

The cost of debt is more difficult to determine when bonds have floating interest rates, are convertible into common shares or redeemable at the discretion of the investor, are callable by the issuer, or have purchase fund requirements.

**Cost of Preferred Shares**

The cost of preferred shares is calculated using the implied cost of preferred shares. The formula is the same as the implied cost of common equity except the dividend growth rate is zero as preferred share dividends are fixed.

kp = D1 / P0

kp – Cost of preferred equity

D1 – Next year’s dividend

P0 – Current share price

CAPM is not used to calculate the cost of preferred shares as these shares have fixed payments like debt that are uncorrelated with the market portfolio so their betas are typically very close to zero. Like bonds, if the price of the firm’s shares cannot be accurately determined, the cost of preferred shares can be estimated using firms with the same credit rating. If a firm does not have a formal credit rating, a synthetic preferred share credit rating can be estimated. The credit rating agencies have separating rating scales for short-term debt securities, long-term bonds, and preferred shares.

Most preferred shares have fixed dividends and unlimited lives, but these features do vary. Some preferred shares have cumulative, adjustable, or participating dividends; are convertible into common shares or redeemable at the discretion of the investor; are callable by the issuer; or have limited terms that force the company to re-purchase the shares at set time intervals over their lives. These features make it more difficult to estimate the cost of the preferred shares.

**Incorporating Issuance Costs**

Issuance or flotation costs include the accounting, legal, and investment banking costs incurred by companies when raising new debt and equity capital. Debt issuance costs are the lowest as these securities are the easiest to sell due to their lower risk. Common shares are risker and more difficult to sell so their issuance costs are much higher especially for initial public offerings, growth firms, or companies experiencing financial distress. Issuance costs for preferred shares fall between those of debt and common shares, but they are closer to debt because of their similar features and risk level.

Issuance costs are included in the capital budgeting process using one of two methods:

**Increase the cost of capital**. From the company’s perspective, issuance costs reduce the proceeds received when they sell new debt or equity securities as their investment banker takes a portion of what is raised before remitting the remainder to the issuer. This is reflected in the cost of capital by deducting after-tax issuance costs per share (f) from the share or bond price.

Retained earnings kc = (D1 / P0) + gd

New common shares kc = D1 / (P0 – f) + gd

New preferred shares kp = D1 / (P0 – f)

New debt: kd after tax (kd) (1 – t) / (1 – f)

Issuance costs are approximately 7% for seasoned common equity issues but this rises to well above 10% for initial public offering. Most companies use retained earnings and do not issue new common equity because of these high issuance costs and potential control issues that may arise from selling new shares. Debt issuance costs average 2% but there is considerable variation in this rate depending on the size of the issue and the firm’s credit rating.

**Include as a negative initial cash flow.** After-tax issuance costs are included as a negative initial cash flow in the capital budgeting analysis just like the cost of the asset and related expenses such as transportation, installation, and taxes.

The first method is the least preferred mathematically as it spreads the issuance costs out over the life of the project through a higher cost of capital instead of recognizing them all at the beginning when they are incurred. The decrease in the project’s net present value caused by the increase in the cost of capital under the first method does not equal the decrease in net present value when issuance costs are deducted initially under the second method.

Some still prefer adjusting the cost of capital upwards because it emphasizes the importance of issuance costs which can be high especially for common equity. Others feel the cost of capital should only reflect the risk of the project so issuance costs should not be included. The second method is recommended by academics and it is more commonly used in practice. The choice of methods does not usually have a material effect on a project’s net present value.

**Weighted Marginal Cost of Capital**

A firm’s WACC reflects the risk level of its existing business. If a company ventures into a new industry with a different risk level, a new weighted marginal cost of capital (WMCC) should be calculated. WACC is a company-wide measure, so diversified companies also need to compute separate divisional costs of capital that correctly measure the risk level of each business unit. If this is not done, riskier divisions will select projects they should not because they use a lower average corporate WACC. Safer divisions will refuse projects they should not because they use a higher average corporate WACC.

Divisional costs of capital are difficult to determine as the financial data needed to calculate the cost of debt and equity are usually only available for the company as a whole. An appropriate cost of common equity can be estimated for a project in a new division or industry by using the average or median beta of a group of guideline or comparable companies that operate in that industry only. These companies have similar risk levels and are frequently referred to as pure plays. Pure plays are difficult to find in practice because most businesses, especially larger ones, are diversified. Their capital structures may not be the same either which affects their risk level. A firm’s equity beta can be adjusted for varying borrowing levels though using the formula:

BL = BU (1 + (1 – t) (D/E))

BL – Levered equity beta

BU – Unlevered equity beta

t – Marginal tax rate

D/E – Debt-to-equity ratio

The comparable company method is also used to determine the cost of capital for private companies that do not trade publicly and lack sufficient market data to calculate their own betas. A beta estimated using comparable company data is called a proxy beta.

WACC also needs to be adjusted for varying project risk. Some projects are routine so they warrant a lower cost of capital than the average, while others are riskier and should have a higher than average rate. For example, a company whose WACC is 8% could make the following adjustments:

**Exhibit 2: Project Risk Adjustments**

|  |  |  |  |
| --- | --- | --- | --- |
| **Project Risk Category** | **Project Types** | **Adjustment** | **WACC** |
| High | New product expansions | +2% | 10% |
| Moderate | Cost savings projects  Existing product expansions | -0% | 8% |
| Low | Equipment replacement | -2% | 6% |
| Mandatory | Environmental or safety equipment | Not applicable | Not applicable |

The adjustments used to incorporate project risk are determined subjectively based on company experience. Mandatory projects must be completed due to a government or legal order, so the cost of capital is not relevant.

* 1. **| CAPM – Risk-free Rate and Market Risk Premium**

Both researchers and practitioners are overly focused on beta when using CAPM. Correctly determining the risk-free rate and MRP is also critical when estimating a firm’s cost of common equity.

**Risk-free rate.**  The risk-free rateshould be based on government debt securities with a maturity that matches the life of the capital project being analyzed. Even though government bonds are free of default risk, they are exposed to interest rate risk, so rates rise as maturities increase. Rates on short-term instruments such as the 90-day treasury bill should not be used unless the project has a very short life which is unlikely.

The duration of the cash flows of the government bonds selected should also match the duration of the cash flows of the capital project to incorporate re-investment risk. This means bonds that pay a coupon should be used for capital projects that pay out cash over their lives while stripped bonds should be used if the cash flows are paid out at the end of the investment only. A bond’s duration is not the same as its maturity. A bond’s maturity is simply its term, while duration (i.e. Macaulay duration) is the [weighted average](https://www.investopedia.com/terms/w/weightedaverage.asp) [term to maturity](https://www.investopedia.com/terms/t/termtomaturity.asp) of the bond’s cash flows. In practice, a bond’s duration is usually ignored and only its maturity is considered as it has little effect on the rate used.

The 20-year or 30-year government bond rate is typically used as the proxy for the risk-free rate as this timeframe reflects the infinite lives of most capital projects. These long-term rates are also more stable than short-term rates and there is little difference between the 20-year and 30-year rates due to the flatter shape of the yield curve at higher maturities. The 20-year rate is preferred as it is used by many financial information providers. Whatever term is chosen, companies should ensure that the term of the risk-free rate is the same as the risk-free rate used in calculating the MRP. Risk-free rates vary by country so analysts should not use a firm’s domestic risk-free rate to assess international projects.

Since the 2008 financial crisis, interest rates globally have fallen well below their long-term averages first due to a “flight to quality” by investors and then because of quantitative easing by the central banks. This highlights the importance of using a normalized risk-free rate that reflects the long-term average return of government bonds and not their current spot rate. Interest rates can be normalized using either a simple average of historical rates over a long period such as 20 years or the build-up method. The build-up method combines estimates of the long-term real risk-free rate and the long-term inflation rate to determine the nominal risk-free rate. These estimates are based on economic factors such as demographics, saving patterns, output growth, and productivity.

**Market risk premium.** MRP, also called the equity risk premium (ERP), is the extra return investors require to move from a risk-free investment in government bonds to an investment consisting of the market portfolio of risky stocks. Miscalculating the MRP is the greatest source of error when determining the cost of capital. Firms must take great care to estimate it correctly themselves or to find a financial information provider who can supply a reliable estimate. This is difficult given the variety of methods used by researchers and practitioners, a lack of agreement on which approach is the most accurate, high standard error, and low correlation between estimated and actual results.

Some analysts believe that the MRP’s past performance is the best predictor of its future performance, so they use historical market data. Other analysts think the MRP should be calculated using forward-looking information.

**Historical market risk premium.** Only a broad-based, market value-weighted stock index like the S&P 500 or Russell 3000 representing a large proportion of the value of all publicly-traded shares should be used to estimate the MRP. Specialized or small indexes like the DOW 30 are avoided as they are not representative of the market portfolio. As discussed, the 20-year or 30-year treasury rate correctly measures the risk-free rate.

Most analysts average the MRP over a long measurement period as this equals the extended life of most capital projects. The MRP varies substantially in the short-term but reverts to the mean in the long-term. Some analysts use reliable market data going back to 1926 which is available through the Center for Research in Security Prices (CRSP) at the University of Chicago. They feel this is more stable, provides a larger sample size, incorporates more economic events such as wars or high inflation that have occurred in the past and may recur in the future, and results in the lowest standard error for the MRP estimate. Others use shorter periods as they are thought to be more representative of the current economy, exclude events from the past such as the Great Depression or World War II that are not relevant today, and incorporate recent changes in the return spread between stocks and bonds. Many feel the return spread between risky stocks and safe bonds has fallen due to the expansion of the social safety net, an increase in dual-income families, and other factors that have made people more willing to accept risk. Globalization may also have led to greater financial market competition and reduced transaction costs so investors do not require as high of a return.

Financial information providers supply historical MRPs for short, medium, and long-term horizons so analysts can decide which time horizon is the most appropriate. Information providers may also adjust historical MRPs to eliminate periods of artificially low interest rates due to government intervention such a during World War II and boom years up to the beginning of the Korean War or the years following the 2008 financial crisis to provide a more reliable estimate. Research indicates that MRPs calculated using historical data consistently overestimate actual MRPs. Shorter measurement periods are warranted, but the smaller sample size increases the standard error of the MRP estimate substantially.

The historical MRP is calculated as the difference between the arithmetic or geometric mean return of the annual stock and bond returns over the measurement period. The arithmetic mean is always higher than the geometric mean and the difference increases as returns become more volatile. Arithmetic mean captures the short-term variability of equity returns resulting in a higher MRP and cost of common equity. The geometric mean takes a longer view of this variability recognizing that it will likely cancel itself out over time causing the MRP and cost of common equity to fall. The use of the arithmetic mean return instead of the geometric return by most financial information providers may explain why historical data consistently overstates the MRP. Employing the geometric mean as well as a multi-period instead of an annual return interval may improve estimates. Survivorship bias also inflates MRP estimates as poorly performing or defunct companies are eventually removed from the index leaving only the better performing firms with lower risk Some financial information providers adjust estimates for this bias.

MRPs vary depending on the nature of a country’s economy such as whether it is emerging, developed, high-growth, mature, resource-based, or technology-focused. Countries also have varying political risks and attitudes towards risk reflecting their different histories and cultures which affects the MRP. Globalization and the free movement of capital between countries are bringing the MRPs of different countries closer together and causing MRPs to fall overall.

**Forward-looking market risk premium.** A forward-looking or implied MRP can be estimated using the one-stage DDM and data for an appropriate stock index. The risk-free rate is then deducted from the market rate to determine the MRP.

Formula 1 =

Formula 2 km = +

Dividends include the cash dividends and stock repurchases of all publicly-traded companies in the stock index, the share price is the total market value of all shares, and growth is the expected long-term growth rate which can be estimated using the average historical dividend growth rate, expected long-term economic growth rate, or sustainable growth rate. This estimate may be improved by using a multi-stage DDM with higher initial growth that regresses to a lower long-term growth rate.

Another variation of the DDM formula shows the market return is equal to the stock market’s earnings yield.

Formula 1 =

Formula 2 =

Formula 3 =

Formula 4 =

In formula 3, market return (km) and ROE are assumed to be equal as firms in a mature market generally earn their cost of common equity only with no excess profits. Again, the risk-free rate is deducted from the market rate to determine the MRP.

Other forward-looking MRP models survey investors, managers, and academics as to what MRP is appropriate in current market conditions or use credit default or bond yield spreads.

**1.3 | CAPM – Betas**

Researchers and practitioners devote considerable resources to improving the accuracy of CAPM. Some adjust how beta is calculated using company share price data. Others believe company share price data is unreliable and use industry or accounting data instead. Most find that beta underestimates the cost of common equity for small firms so they add a size premium.

**Raw beta.** A firm’s raw beta is the slope of the ordinary least of squares (OLS) regression line between the returns or excess returns on the market portfolio and the returns or excess returns on the company’s share over a past measurement period. Excess return is the difference between the market portfolio return or company return and the 90-day treasury bill rate. Making this adjustment eliminates the effect of changing inflation over the measurement period resulting in a more accurate regression coefficient. The 90-day treasury bill rate is used instead of a long-term rate which better matches the maturity of the project so interest rate risk is excluded. Excess returns are normally used by academics, but they have little effect on the results of the regression, so they are often ignored by practitioners. If the treasury rate is unusual and thus not representative of inflationary expectations, then the OLS regression should use returns and not excess returns.

Beta can also be calculated as:

Bi – Beta of the company

Ri – Return or excess return on the stock

Rm – Return or excess return on the market portfolio

=

Like OLS, covariance measures the extent to which the market and company returns fluctuate together. A low covariance between the two returns means a smaller beta.

All returns are historical total returns that include both dividends and capital gains and are adjusted for stock splits. These returns are assumed to be representative of future business and economic conditions. If they are not, the regression model will be a poor predictor of beta and an alternative forward-looking approach should be considered.

A company’s raw beta varies with the measurement period and return interval selected. It is normally calculated over five years using monthly returns which provides a large sample size (i.e. 60 observations), more stable systematic risk, and minimal non-trading bias. A company’s level of systematic risk changes over time as it grows, enters or exits markets, alters the use of operating or financial leverage, changes business strategies, or experiences financial distress. A measurement period of more than five years will likely result in a beta that is not representative of its current performance. If a company is not yet five years old or its level of systematic risk has changed materially in the past five years, a shorter measurement period is warranted although this will reduce the sample size and increase the standard error of the beta estimate.

Non-trading bias is a problem for small businesses whose shares do not trade as frequently as those of larger companies. Measuring returns often can distort beta by giving the impression that they are more stable. Returns are typically measured on an intra-day, daily, weekly, monthly, quarterly, or yearly basis. Research indicates that intra-day and daily return intervals introduce significant non-trading bias for small companies while quarterly and yearly intervals provide too small of a sample size. Research also shows that eliminating return observations that are outliers will improve the regression results.

As the calculation of MRP, only a broad-based, market value-weighted stock index like the S&P 500 or Russell 3000 that represents a large proportion of the value of all publicly traded shares should be used to estimate beta. Market value-weighted indexes weight each company’s share price by the total market value of its shares. An exception to this rule is if one industry or a few companies dominate the stock index so that the index does not fairly represent the overall economy. In these cases, an equal-weight stock index should be used. Some research indicates equal-weighted indexes are preferable in all cases.

The statistical quality of raw betas should be carefully examined by analyzing the OLS regression’s R squared, t-stats, and standard error. R squared measures the amount of variation in Y (i.e. company return) accounted for by changes in X (i.e. market return). High t-stats (i.e. 2.0 or higher) and low p-values (close to 0.0) for the x-coefficient and y-intercept indicate they are statistically significant (i.e. different than 0.0) and a linear relationship exists. The standard error is used to establish a confidence interval for the x-coefficient or beta. A 95% confidence interval is two standard errors around the x-coefficient. Increasing the sample size by lengthening the measurement period and shortening the return interval improves the statistical quality of the model but results in a beta that is not representative of current share performance or has a non-trading bias.

Raw Betas are available through financial information providers such as Barra, Bloomberg, Thompson Financial, Reuters, and Value Line but each employs different methods resulting in varying estimates. When selecting an information provider, users should thoroughly analyze the statistical quality of their estimates and be careful not to mix betas taken from different sources.

**Adjusted betas.** Researchers and practitioners have developed statistical methods to improve the quality of raw betas. Some of these adjusted or modified betas include:

**Sum beta.** Large firms receive considerable media coverage and are followed by a sizeable group of analysts and institutional investors, so their share prices react quickly to new information. Stock movements for small companies tend to lag the overall market because of their reduced market liquidity which is called the lag effect. This results in a raw beta that underestimates the true beta. Some researchers and practitioners increase their beta estimates to compensate for this effect by using sum beta.

BSum = Bn + Bn–1

When calculating sum beta, the return or excess return on the company’s share is regressed against both this period’s and last period’s return or excess return on the market. The two betas are then added together to compensate for the slower rate at which new information influences the share prices of small companies. The lag effect can also be addressed by using an annual beta that uses a yearly instead of a monthly return interval. New information will have had time to be incorporated in a small firm’s share price, but the sample size will be too small (i.e. five observations) resulting in a high standard error.

**Blume adjusted beta.** A company’s beta usually regresses towards the industry or market’s average beta over time as it moves through the development, growth, expansion, and maturity stages of the business life cycle. This is especially true for firms with extreme betas (i.e. very high or very low) and is called the shrinkage effect. Betas are adjusted towards the mean to provide a forward-looking measure of risk that does not overstate the firm’s beta. Blume’s adjusted beta states:

BBlume = 0.371 (BMarket) + 0.635 (BRaw)

Coefficients are based on Blume’s studies of the rate at which betas regress towards the mean. Because BMarket is 1.0, Blume’s adjusted beta is typically shown as:

BBlume = 0.371 + 0.635 (BRaw)

**Vasicek adjusted beta.** This beta incorporates the shrinkage effect like the Blume adjusted beta. The difference is that betas with high standard errors are regressed towards the industry beta at a faster pace than those with low standard errors. High beta stocks usually have the greatest standard error so they are adjusted more. This is accomplished by prorating the lower industry beta using the higher variance of the company’s raw beta. Also, instead of using the beta of the market, industry beta is used as this is the value that firms will move towards.

BVasicek = () BIndustry + () BRaw

**Downside beta.** Risk can be measured as the potential to lose money in a downturn which is called the downside effect.

BDownside =

Beta is only calculated in periods where both the company and the market have negative returns. A downside beta above 1.0 means a firm loses more than the market during a downturn and a beta below 1.0 means it loses less.

**Industry and peer group betas.** Raw betas calculated using company data are often statistically unreliable with large confidence intervals even after adjusting for the lag, shrinkage, or downside effects. Many researchers and practitioners instead use average betas from comparable companies or the industry as a whole. Industry betas are average betas for the companies in an industry that have been purified by eliminating the effect of sales outside of the industry as defined by one of the industrial classification systems such as the Standard Industrial Classification (SIC) system. Companies can then calculate a sales-weighted or equal-weighted average of the betas for all the industries they operate in to determine their peer group beta. An equal-weighted average is likely better for small firms as larger firms dominate most indexes and usually have lower betas. Instead, some financial information providers supply industry betas separately for the small and large-cap firms in an industry.

An industry beta is calculated by regressing the betas of companies with similar operating segments (Y) against the percentage of their sales in each segment (X). The y-intercept or constant is set to zero. The coefficients for each operating segment are the industry betas which are used to calculate peer-group betas. Industry betas are also called full-information betas.

Peer group betas are excellent for private companies that do not have the share price data needed to calculate their own betas or public companies whose data is unreliable. Research also shows these betas are statistically more reliable than beta’s calculated using company data only.

**Accounting betas.** Besides using stock market data, companies can estimate their beta using accounting data. One approach is to regress the change in a company’s profit against the change in the industry’s or stock index’s profit to estimate beta. Profit becomes a proxy for the share price. An alternative is to develop a regression model using industry data that estimates beta based on fundamental performance indicators that influence beta. These may include business risk as measured by the coefficient of variation of operating income, financial risk as measured by the debt-to-equity ratio, maturity or age of the firm as measured by the dividend payout ratio, and earnings growth as measured by the growth rate in EPS. Company ratios are then inputted into the regression model to estimate the firm’s beta. Betas calculated using these approaches are referred to as accounting or fundamental betas. They are useful when calculating the beta of a division or a privately-held company. Some analysts prefer accounting betas as they believe earnings and other accounting measures are more representative of a firm’s performance than its share price.

**Unlevered and levered betas.** As a firm’s business risk and financial risk increase so will its market risk and beta. Business risk is the underlying variability of a company’s operating profits or earnings before interest and taxes (EBIT) which is determined by its sales risk and operating risk. Sales risk increases as businesses become more cyclical and experience greater industry competition and technological change. Operating risk increases as firms use more operating leverage and the variability of their input prices rise. Operating leverage is the amount of fixed costs in a company’s cost structure. Higher fixed costs cause more variability of EBIT as these costs remain constant regardless of sales volume.

Business is risk is the main determinant of a firm’s target or optimal capital structure. Firms prefer to finance their operations using debt because of its low after-tax cost. But they are not going to borrow more and expose themselves to greater financial risk if they already have high business risk as the variability of EBIT will put them in jeopardy of not being able to service their debt. Firms with high business risk borrow less and those with low business risk borrow more on average.

If a firm uses comparable companies or industry data to estimate its beta, inaccuracies will occur due to varying levels of financial leverage between the firms. As discussed, comparable company and industry equity betas can be unlevered and then re-levered to match a firm’s borrowing level using the formula:

1BL = BU (1 + (1 – t) (D/E))

BU – Equity beta unlevered

BL – Equity beta levered

t – Marginal tax rate

D – Market value of debt

E – Market value of equity

This formula assumes the debt’s beta is zero, but if a company is experiencing financial distress, the debt’s beta will rise above zero as it becomes uncertain whether investors will receive the interest and principal payments promised. Debt beta is calculated the same way as equity beta. A debt instrument’s return is regressed against the return on the market portfolio at monthly intervals over a five-year measurement period. The coefficient of the regression is debt beta. If debt beta (BD) is not zero, the formula for levering and re-levering equity beta is:

1BL = BU (1 + (1 – t) (D/E)) (BU – BD)

Also, if a company is experiencing financial distress, tax savings are unlikely to be realized due to expected future business losses or unused loss carryforwards, so the marginal tax rate will fall and may even become zero. Debt betas are difficult to measure accurately and are generally quite small unless a company is experiencing financial distress. Most financial information providers assume a debt beta of zero and a normal marginal tax rate, although some do attempt to adjust for these factors.

Betas should be de-levered using the average debt-to-equity ratio over the period the betas were calculated which is typically five years. Applying the current debt-to-equity ratio will distort the results if the ratio is changing. Betas should be re-levered with the company’s target capital structure.

Comparable companies or firms in the same industry generally have similar levels of operating leverage, but if it does differ between firms, analysts may unlever and re-lever betas for operating leverage using the following formula:

BOP – Operating beta

BU – Unlevered beta

FC – Fixed costs

VC – Variable costs

= × (1 + )

In practice, a firm’s fixed and variable costs are not disclosed publicly so its operating beta may be difficult to calculate.

**1.4 | CAPM – Size Premiums**

CAPM only considers market risk as measured by beta when calculating the cost of common equity. Research indicates a firm’s cost of common equity is also negatively correlated with its size which is not captured by beta. This is called the size effect. Realized returns were compared to estimated returns using CAPM for different sizes of companies. The difference was positive and grew as firms became smaller. The difference was the most pronounced for the smallest companies.

**Exhibit 3: Size Premium for S&P 500 from 1926-2011**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company Size Based on Market Capitalization** | **Beta** | **Average Realized Return** | **Average Estimated Return Using CAPM** | **Average Size Premium** |
| **Decile 1 – Largest** | 0.91 | 10.82% | 11.20% | -0.38% |
| **Decile 2** | 1.04 | 12.78% | 12.00% | 0.78% |
| **Decile 3** | 1.10 | 13.37% | 12.43% | 0.94% |
| **Decile 4** | 1.13 | 13.78% | 12.60% | 1.18% |
| **Decile 5** | 1.16 | 14.57% | 12.83% | 1.74% |
| **Decile 6** | 1.19 | 14.76% | 13.01% | 1.75% |
| **Decile 7** | 1.24 | 15.15% | 13.38% | 1.77% |
| **Decile 8** | 1.30 | 16.27% | 13.76% | 2.51% |
| **Decile 9** | 1.35 | 16.88% | 14.07% | 2.81% |
| **Decile 10 – Smallest** | 1.41 | 20.56% | 14.46% | 6.10% |
| **Mid-cap (decile 3-5)** | 1.12 | 13.70% | 12.56% | 1.14% |
| **Low-cap (decile 6-8)** | 1.23 | 15.16% | 13.28% | 1.88% |
| **Micro-cap (decile 9-10)** | 1.36 | 18.03% | 14.14% | 3.89% |

Source: Ibbotson (2012). SBBI Valuation Yearbook.

To address this measurement problem, financial information providers supply size premiums equal to the realized return minus the estimated return for each size category. The appropriate premium is then added to the cost of common equity in CAPM to incorporate the risk that beta does not capture. Size premiums are often referred to as beta-adjusted size premiums as the estimated return is calculated using CAPM which eliminates market risk.

kc = kf + Ba (km – kf) + Size Premium

The methodology used to calculate size premiums varies with the financial information provider. As shown in Exhibit 3, one approach is to divide all publicly-traded companies into deciles (i.e. 10% groupings) based on their market capitalization. The arithmetic mean return is typically used to calculate the average size premium for each category over a different measurement period that can go back to 1926. Some information providers add more categories to provide greater precision and then smooth the results for each category so users can estimate size premiums for companies that fall between the category means. Information providers also calculate size premiums using other measures of firm size besides market capitalization including book value of equity, five-year average net income, total assets, five-year average EBITDA, sales, and the number of employees. This helps eliminate biases such as how to classify large firms who have low market capitalizations due to their greater use of debt. A firm may also not be able to estimate its market capitalization accurately if it is privately held, so other measures of size allow it to still determine an appropriate size premium.

Most academics agree that size premium exists but continue to debate why smaller firms have a higher cost of common equity that is not captured in beta. The best reasons for the size effect include:

* Owners of small businesses have difficulty diversifying their investment holdings as most of their wealth is concentrated in their businesses which exposes them to unsystematic risk.
* Small companies have limited financial resources making it more difficult for them to survive an economic slowdown or cope with new market competition.
* Smaller firms have fewer barriers to entry leading to greater competition.
* Investors in small firms are being compensated for lower investment liquidity and higher transaction costs compared to those in large companies.
* Small businesses devote fewer resources to advertising and research and development and are unable to attract the best personnel giving them less control over their future.
* Fewer analysts follow smaller companies and these analysts have more difficulty examining small firms using traditional methods resulting in poorer financial oversight and greater risk.

Some researchers still question whether size premiums exist. They raise several questions about the existence of size premiums and how they are calculated.

**Beta calculation.** Size premiums are largest for small firms. Some researchers feel this is because raw betas calculated using OLS do not capture the actual risk of small companies. They find that using either a sum beta or annual beta is more accurate as they result in higher betas and lower size premiums. Some financial information providers do supply sum and annual beta with adjusted size premiums.

**Concentration of small firms.** The size premium is the highest for the smallest companies in the 10th decile but there is considerable variation among businesses in this category. Firms who simply use the average size premium for this category will distort their cost of common equity using CAPM. Financial information providers compensate for this by having more categories overall or further subdividing the categories with the smallest companies to provide a more precise estimate. Besides healthy small firms, the 10th decile also includes many speculative start-ups with no sales and businesses experiencing financial distress including many highly leveraged large companies with low market capitalizations. Raw betas calculated using OLS generally understate the riskiness of these companies resulting in higher size premiums. Some information providers compensate for this by supplying information about company default probability or earnings size and variability. This allows users to carefully analyze the composition of firms in each category to determine how similar they are to those companies and then adjusting the size premium if warranted. Other financial information providers simply eliminate all speculative start-ups, distressed firms, highly leveraged firms, and financial institutions that are operationally unique before calculating size premiums. Providing size premiums using other measures of firm size besides market capitalization also helps address the problem of highly leveraged firms.

**Variability of size premiums.** Size premiums are cyclical which means they vary considerably over the short term but are much more stable over the longer term. During some periods, they disappear entirely leading researchers to claim that they do not exist. This is illogical as even though small companies are riskier than large companies and should earn a higher return in the long-term, it does not mean they will outperform large companies every period. Small companies substantially outperform large companies during periods of high economic growth and underperform them during periods of slow economic growth. Over the extended time horizon of most capital projects, companies are likely to experience both rapid and slow economic growth supporting the use of a size premium that is calculated over a longer period.

**Changing size premium.** Most small firms expect to grow into large companies and incorporate this in their financial projections. Some researchers feel that it is illogical for them to include a size premium in their discount rate if they expect to grow into a large company soon. The problem with this position is that investors do not know which small company will successfully grow into a larger firm, so they require a premium that reflects the average risk of small companies.

**Downside risk.**  As discussed, small companies substantially outperform large companies during periods of high economic growth and underperform them during periods of slow economic growth due to their more limited financial and operational resources. Many researchers believe this added downside risk is the cause of the size premium. Some have developed models to incorporate downside risk into CAPM. One approach is to use an adjusted beta equal to the firm’s raw beta times a ratio of its upside and downside betas.

**1.5 | Cost of Long-term Debt**

To calculate the cost of long-term debt, a firm first determines the current market rate and fair market value of each of its debt instruments and then computes a weighted average cost of debt. Coupon rates and book values found in the financial statements should not be used unless they approximate market values or if reliable market information is unavailable.

In addition to the riskiness of the company, the cost of borrowing is affected by an instrument’s term to maturity, whether it has a floating interest rate, any interest rate caps and floors, and other features such as whether the debt is callable, convertible, retractable, extendible, collateralized, guaranteed, or subordinate to other securities. Interest rates vary over the life of a floating-rate bond subject to any caps or floors, so borrowing costs must be estimated separately for each year before calculating the yield to maturity. Yield-to-call is used if the coupon rate on a callable bond is above the current market rate which greatly increases the likelihood that the issue will be refinanced in the near future by the issuer at a lower rate. Hybrid debt securities like convertible bonds are divided into their separate debt and equity components. The interest rate on guaranteed debt is raised to eliminate the effect of any sureties given. Bank loans and leases do not normally trade publicly, so recently negotiated loans or leases with the same maturity and similar features are used to determine their current market rates and fair values.

A simpler but less precise method for calculating a company’s cost of debt is to establish a corporate yield curve for other firms with the same credit rating and then prorating these interest rates using the book value of the company’s debt at each maturity. If a company plans on changing the maturity of its liabilities in the future, this should be reflected in the weightings. If a firm is not rated, an estimated or synthetic credit rating can be purchased from one of the credit rating agencies such as Standards and Poor’s or Moody’s. These ratings are readily available and less costly than a formal credit investigation. Credit rating agencies use proprietary credit rating prediction models based on different financial ratios.

**Exhibit 4: Aggregate Metrics by Rating Category**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ratios** | **Median** | | | | | | | **Median** | |
| **Aaa-Aa** | | **A** | **Baa** | **Ba** | **B** | **Caa-C** | **Investment Grade** | **Speculative Grade** |
| Interest coverage | 16.0 | | 8.6 | 5.4 | 3.7 | 1.9 | 0.7 | 6.5 | 2.1 |
| Asset coverage | 3.7 | | 2.4 | 2.3 | 2.0 | 1.3 | 1.0 | 2.4 | 1.4 |
| Leverage | 31.6% | | 41.7% | 44.8% | 49.8% | 68.7% | 92.2% | 43.6% | 66.8% |
| Cash flow-to-debt | 52.4% | | 32.6% | 25.8% | 21.6% | 12.1% | 6.4% | 28.4% | 12.7% |
| Return on assets | 11.6% | | 7.5% | 5.3% | 4.4% | 1.7% | -2.1% | 6.3% | 1.9% |
| Profit | 11.8% | | 9.0% | 6.7% | 5.0% | 2.0% | -2.6% | 7.8% | 2.1% |
| Liquidity | 7.8% | | 4.7% | 4.0% | 4.3% | 3.9% | 3.3% | 4.6% | 3.9% |
| Revenue stability | 7.2 | | 7.3 | 6.1 | 5.2 | 6.1 | 7.3 | 6.6 | 5.9 |
| Source: Moody’s Investors Service (2006). The Distribution of Common Financial Ratios by Rating and Industry for North American Non-financial Corporations. | | | | | | | | | |
| **Ratio Definitions** | | | | | | | | | |
| Interest coverage | | (EBIT – Interest capitalized + (1/3) \* Rental expense) / (Interest expense + (1/3) \* Rental expense + Preferred dividends / 0.65) | | | | | | | |
| Asset coverage | | (Total assets – Goodwill – Intangibles) / Total debt | | | | | | | |
| Leverage | | (Total debt + 8 \* Rental expense) / (Total debt + 8 \* Rental expense + Deferred taxes + Minority interest + Total equity) | | | | | | | |
| Cash flow-to-debt | | (Net after-tax income before extraordinary items + Depreciation – Dividends) / (Total debt + 8 \* Rental expense) | | | | | | | |
| Return on assets | | Net after-tax income before extraordinary items / 2-year average net assets | | | | | | | |
| Profit | | Net after-tax income before extraordinary items / Net sales | | | | | | | |
| Liquidity | | Cash and marketable securities / Total assets | | | | | | | |
| Revenue stability | | 5-year average net sales / 5-year standard deviation net sales | | | | | | | |

Source: Moody’s Investors Service (2006). The Distribution of Common Financial Ratios by Rating and Industry for North American Non-financial Corporations.

Besides bonds, commercial loans, and leases, other obligations including future income taxes, contingent liabilities, and pension liabilities can make up a significant portion of long-term liabilities. There are opposing views among academics about whether these liabilities should be considered when calculating the cost of debt. Some feel that they are owed to the government, employees, and other parties so they are substitutes for debt financing and should be included. Others feel that large tax and pension liabilities will likely disappear over time as temporary differences between accounting and taxable income are reversed and pensions become fully funded, so they should be excluded. Also, if these liabilities ever have to be settled in cash, they will be charged against net income which is included in equity. Most practitioners do not include these obligations in the cost of debt as they were not specifically negotiated to finance a project and are not interest bearing.

**1.6 | Alternate Cost of Common Equity Methods**

CAPM is a simple model that is easy to apply but it has several empirical problems. Researchers and practitioners have tried to improve results by using adjusted betas, accounting betas, industry betas, unlevered and levered betas, company risk adjustments, and size premiums, but have had limited success. Other alternative approaches have also been developed that avoid using beta entirely or combine beta with other factors to estimate the cost of common equity more accurately. Two of these methods, the implied cost of common equity and treasury spread, were previously examined. Three other popular methods are the build-up method, multi-stage implied cost of common equity, and Fama French 3-factor model which are provided by financial information providers.

**Build-up Method**

The build-up method is used by public companies that cannot accurately calculate their betas using stock market data or private firms whose shares do not trade publicly.

Market specific risk

Company specific risk

kc = kf + Market risk premium + Size premium + Industry risk premium + Company risk premium

The market specific risk is captured by the risk-free rate, MRP, and size premium. The industry risk premium and company risk premium incorporate company specific risk separately instead of using beta. All components except for the company risk premium are supplied by financial information providers.

The industry risk premium is calculated as:

IRP – Industry risk premium

IB – Industry beta

MRP – Market risk premium

IRP = IB × MRP – MRP

Industry beta measures an industry’s risk relative to the market much like a company’s beta. In the formula, MRP is multiplied by the industry beta to determine total market and industry risk. If the industry beta is below 1.0, the total market and industry risk is less than the MRP because of the lower risk of the industry compared to the market. The opposite is true if the industry beta is above 1.0. Industry beta is scaled to zero by deducting the MRP, so the industry risk premium is a positive or negative adjustment that can simply be added to the other components of the cost of common equity.

Company risk premium incorporates risk factors specifically related to the firm and not the market or industry. Some factors to consider include:

**Variability of operating cash flows.** Firms with more geographical diversification, greater product variety, less price sensitivity, a larger focus on luxury products, extensive natural resource reserves, or a high number of new products under development relative to the industry have a lower cost of equity.

**Levels of operational and financial leverage.** Companies with fewer fixed operating and interest costs relative to the industry have more stable earnings over the business cycle and a lower cost of equity.

**Customer and supplier concentration.** Businesses with a limited number of customers or suppliers relative to the industry are more susceptible to financial distress and have a higher cost of equity.

**Strength of management.** Smaller companies in an industry have more difficulty attracting and retaining effective managers due to lower pay and fewer opportunities for promotion so they have a higher cost of equity.

**Key person dependence.** Smaller companies in an industry are more dependent on a few key managers that expose these firms to greater financial distress if one leaves so they have a higher cost of equity.

**Pending lawsuits.** Firms with a greater number of lawsuits such as product liability, patent infringement, or employee harassment relative to the industry have a higher cost of equity.

**Competitive pressures.** Businesses located in more competitive local markets due to overcapacity or higher operating costs relative to the industry have a higher cost of equity.

Company risk premium adjustments are made subjectively. Some of the risk factors such as the strength of management and competitive pressures may also be in the size premium, so businesses should be careful not to double count them.

Overall, determining the cost of common equity using individual company betas is error-prone. Relying on industry and company risk adjustments usually provides more accurate results.

**Multi-stage Implied Cost of Common Equity**

Determining the implied cost of common equity using the one-stage DDM is appropriate for mature companies whose growth rate is expected to remain constant and not exceed the nominal growth rate of the economy of 3.0% to 4.0%.

kc = (D1 / P0) + gd

Other companies may have a higher growth rate initially due to a new product innovation for example followed by a mature-growth stage with lower growth once industry competition intensifies, new companies enter the market, and demand stabilizes. For these firms, the two or three-stage DDM will likely provide a better estimate of the cost of common equity.

P0 = + + +

The three-stage DDM incorporates a transition period from the high to mature growth stages. Firms can estimate their growth rates for the different stages or use consensus analyst growth forecasts supplied by the different financial information providers.

Many firms do not pay dividends or substitute stock repurchases for dividends to give their managers more financial flexibility. This can be corrected by adding stock repurchases to dividends or using free cash flow to equity (FCFE) as a substitute for dividends. FCFE is the residual cash remaining after a company pays for all its necessary capital investments net of any financing. Agency theory says this cash should be paid out as dividends to the common shareholders since the company has no other positive net present value projects in which to invest. FCFE will be examined further in Module: Business Valuation.

**Fama French 3-factor Model**

CAPM is a 1-factor model that only uses the MRP to estimate the cost of common equity. Fama French 3-factor model adds two additional factors or risk premiums to provide a more accurate measure of a firm’s required rate of return.  These factors include:

**Small Minus Big (SMB).** Measured as the difference in return between the smallest 30% (i.e. small-cap companies) and the largest 30% (i.e. large-cap companies) of stocks based on market capitalization.

**High Minus Low (HML).** Measured as the difference in return between the highest 50% BVPS/P ratio (i.e. value companies) and lowest 50% BVPS/P ratio (i.e. growth companies) stocks based on market capitalization. Value companies have higher BVPS/P ratios because they have poorer growth prospects resulting in a lower share price and a higher BVPS/P ratio. The opposite is true for growth companies.

kc = kf + BMRP (MRP) + BSMB (SMB) + BHML (HML)

Adding SMB and HML addresses the problem that CAPM understates the cost of common equity by not properly accounting for size and value. Small-cap shares earn higher returns to compensate for higher risk caused by their limited access to capital and greater industry competition. CAPM does not incorporate this higher risk but users can correct for it by adding a size premium. Value shares with high BVPS/P ratios earn higher returns to compensate for greater exposure to financial distress. CAPM does not incorporate this higher risk. As a result, the cost of common equity for value shares is too low and the cost of common equity for growth companies is too high.

As with MRP in CAPM, SMB and HML can be calculated over a period going back as far as 1926. Dr. Kenneth French hosts a website where he provides annual MRP, SMB, and HML data for 1927 to 2019. He also provides monthly MRP, SMB, and HML values so betas or sensitivity coefficients between the return on the company’s share and each factor can be calculated over five years with monthly observations. The beta for the MRP will be different in the two models because the Fama French 3-factor model is a multi-regression analysis that includes two other factors.

The sensitivity coefficient for MRP is nearly always > 0.0 as stock returns will move up and down together with the market. If the coefficient is < 1.0, stock returns fluctuate less than the market and the security is safer, and if the coefficient is > 1.0 stock returns fluctuate more than the market and the security is riskier. For the SMB and HML sensitivity coefficients, the neutral value is 0.0. If the coefficient is above 0.0 or positive, it means these securities demonstrate characteristics of small-cap or value investments and their return needs to be adjusted upward. If the coefficient is below 0.0, then the securities demonstrate characteristics of large-cap or growth investments and their return needs to be adjusted downward. The size and sign of the three coefficients provide important information about a company including its return stability and whether it is a small-cap, large-cap, value, or growth firm. In portfolio management, this is referred to as the investment’s style and is frequently used to determine if a security is suitable for certain types of investment funds such as small-cap, large-cap, value, or growth fund.

Fama and French recently introduced a 5-factor model which also includes profitability and investment that is supported by financial information providers. They found companies with higher operating profits perform better and companies with higher total asset growth perform worse. Researchers continue to study other factors hoping to develop a model that more accurately estimates the cost of common equity.

**1.7 | Duff & Phelps**

Duff & Phelps is the most comprehensive provider of cost of capital information globally. It offers five major publications that are updated annually including:

Stocks, Bonds, Bills, and Inflation (SBBI) Yearbook

Valuation Handbook – U.S. Guide to Cost of Capital

Valuation Handbook – U.S. Industry Cost of Capital

International Valuation Handbook – Guide to Cost of Capital

International Valuation Handbook – Industry Cost of Capital

These publications supply the historical data needed to calculate the risk-free rate, MRP, size premiums, and industry average data used to calculate a firm’s cost of capital. Duff & Phelps recently introduced an online platform that includes this information as well as a new tutorial called Cost of Capital Navigator that guides users through the cost of capital calculation process using their data.

For each industry as defined by the SIC system, Duff & Phelps provides the following information:

**Exhibit 5: Cost of Capital Inputs by Industry**

Number of companies

Industry description

Financial ratios

Return on assets

Return on equity

Dividend yield

Current ratio

Operating profit margin

Long-term growth rate EPS

Debt to total capital

Levered and unlevered betas

Raw (OLS)

Blume

Peer Group

Vasicek

Sum

Downside

Cost of common equity

CAPM

CAPM + Size premium

Build-up

Fama-French 5-factor

Implied kc (1-stage and 3-stage)

Cost of debt

Weight average cost of capital

CAPM

CAPM + Size premium

Build-up

Fama-French 5-factor

Implied kc (1-stage and 3-stage)

All information is shown by industry and by large capitalization, small capitalization, and high financial risk companies. MRP is calculated using a proprietary model that uses historical arithmetic mean returns going back to 1926 and forward-looking adjustments based on economic conditions. Beta is calculated six different ways over five years using monthly observations. Excess returns for the industry are regressed against excess returns of the market portfolio. S&P 500 is the market benchmark and the 30-day T-bill rate is used to calculate excess returns. Extreme company betas below 0.0 or above 5.0 are discarded. The cost of common equity is calculated using sum betas and sum beta adjusted size premiums. WACC weights are based on historical cost data for preferred shares and debt and market values for equity. The cost of preferred shares is calculated as the most recent dividend divided by a firm’s book value. The cost of debt is calculated using the 20-year corporate bond yield curve and actual or synthetic credit ratings.

Duff and Phelps also provides an updated forecast of the U.S. normalized risk-free rate and U.S. MRP which it makes available to the public. It currently recommends a normalized risk-free rate of 3.0% effective September 2019 which is down from the previous estimate of 3.5% and a U.S. MRP of 5.0% effective December 2019 which is down from the previous estimate of 5.5%.

Students are encouraged to review the Duff & Phelps website. An online subscription is likely too expensive for a student, but it is very reasonable for a business. In addition to cost of capital information, Duff & Phelps provides other services in the area of business valuations. This module was designed to prepare students to understand much of the terminology and methodology used in this site.

**1.8 | Cost of Capital at Canadian Companies**

**Cost of Capital in Practice**

The cost of capital techniques described in this module are used in industry to varying degrees. Academic research tries to determine how closely practice follows current corporate finance theory. They feel that adhering more closely to current theory increases corporate profitability and overall economic efficiency and, therefore, is of great interest to society. A recent study1 of Canadian businesses found:

**Discount rates used.**  Two-thirds of firms use WACC. Usage is higher among large firm’s likely due to their greater sophistication and access to needed market data.

**Exhibit 6: Preferred Project Evaluation Methods in Canada**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Evaluation Method** | **% Often or Always** | **Full Sample** | **Firm Size** | |
| **Large** | **Small** |
| The company’s overall discount rate (weighted average cost of capital). | 63.6 | 2.44 | 2.80 | 2.35 |
| A rate based on management’s experience. | 43.5 | 1.80 | 1.76 | 1.84 |
| The cost of specific funds planned for financing the project. | 38.2 | 1.70 | 1.72 | 1.70 |
| A risk-matched discount rate for this particular project. | 36.6 | 1.63 | 1.80 | 1.55 |
| A different discount rate for each cash flow that has a different risk characteristic. | 14.1 | 0.85 | 1.21 | 0.77 |
| A divisional discount rate (if the product line of business matches a division). | 11.3 | 0.59 | 0.98 | 0.45 |
| Respondents indicate frequency level based on a five-point scale where 0=never, 1=rarely, 2=sometimes, 3=often, and 4=always. | | | | |

Using WACC is consistent with corporate finance theory, but so are the other methods listed. Adjusting discount rates based on management experience, additional assessments of project risk, or the varying risk level of cash flows are good practices as is calculating a separate divisional cost of capital. CEOs are likely using these methods in unison which demonstrates a strong appreciation of current theory.

**Estimating the cost of common equity.**  Approximately 75.0% of firms estimate their cost of common equity and large firms are more likely to do so than small firms. The methods used include:

**Exhibit 7: Preferred Project Evaluation Methods in Canada**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Evaluation Method** | **% Often or Always** | **Full Sample** | **Firm Size** | |
| **Large** | **Small** |
| Judgement | 60.3 | 2.33 | 2.01 | 2.64 |
| Cost of debt plus equity premium | 52.3 | 2.01 | 1.85 | 2.08 |
| Capital asset pricing model (CAPM) | 36.8 | 1.52 | 1.96 | 1.12 |
| Earnings/price (E/P) ratio | 21.8 | 1.02 | 0.53 | 1.20 |
| Based on what our investors tell us they require | 20.0 | 1.00 | 0.85 | 1.07 |
| Average historical returns on common stock adjusted for risk | 14.1 | 0.81 | 0.46 | 0.93 |
| Accounting return on equity | 17.5 | 0.73 | 0.74 | 0.73 |
| Dividend growth model (dividend yield plus estimate of growth) | 12.9 | 0.66 | 0.48 | 0.74 |
| Multi-factor model | 7.1 | 0.33 | 0.19 | 0.40 |
| By regulatory decisions | 5.9 | 0.29 | 0.19 | 0.34 |
| Respondents indicate frequency level based on a five-point scale where 0=never, 1=rarely, 2=sometimes, 3=often, and 4=always. | | | | |

A major concern is that Canadian companies are too reliant on management judgment. There is a place for applying judgment when calculating the cost of common equity as long as other more sophisticated methods are also used. Also, multi-factor models that consider additional factors besides market risk are not common.

**Capital structure weights.**  Two-thirds of firms use WACC, but they do vary in how they calculate the weights. Most use market value weights (57.7%), followed by target capital structure (23.1%), and then book value (18.0%). This understates the importance of target capital structure because even though a firm determines its capital structure using current market value weights, it still likely has a target capital structure in mind. The same research shows that the majority of firms (65.0%) have a target capital structure, which is higher for large companies (80.0%) than small companies (53.0%). The majority (60.0%) of Canadian businesses who have a target capital structure adhere to it tightly or somewhat tightly while the remaining companies are more flexible. Large firms adhere to their targets more tightly than small firms.

**Differences between countries.** U.S. companies are more likely than Canadian companies to follow current corporate finance theory when determining their cost of capital because that country has a more rigorous corporate governance system and larger firms. Research indicates this gap is decreasing as Canadian companies grow and improve their management practices.

**Cost of Capital at Empire Company Ltd.**

Empire is a Canadian food retailer headquartered in Stellarton, Nova Scotia with approximately CAD 25.1 billion in annual sales and 123,000 employees. All sales are generated through its Sobeys subsidiary using a network of 1,500 franchised, affiliated, and company-owned stores in all 10 provinces. These outlets operate under the brand names Sobeys, Safeway, IGA, Foodland, FreshCo, Thrifty Foods, Farm Boy, and Lawtons Drugs. Empire also operates 350 fuel stations and a real estate investment unit that owns and develops the company’s retail locations.

Empire has nearly doubled its sales and profits over the last ten years growing both internally and through acquisitions in the mature and competitive grocery market. Safeway in Western Canada and Farm Boy in Ontario are two of its most recent additions. Going forward, Empire will continue to develop its full-service stores while focusing more on discounting through its FreshCo chain and on-line delivery. With this growth, it is imperative that Empire accurately determine its WACC so it can assess future investments. Effective May 2019, Empire’s WACC was estimated to be 5.82%.

**Cost of common equity.** Empire’s raw beta was calculated at monthly intervals over the previous five years. The regression results were:



As expected, Empire’s raw beta calculated using company data was statistically unreliable, so it was not used. The 0.7 levered raw beta for the grocery store industry (SIC 541) provided by Duff & Phelps was substituted. Based on CAPM and a normalized risk-free rate of 3.0%, MRP of 5.0%, and a beta of 0.7, Empire’s cost of common equity was estimated to be 6.50%.

kc = 0.03 + 0.7 (0.05) = .065

Another approach would have been to use the build-up method and adjust for company-specific risk such as Empire’s lower credit rating compared to its main competitor George Weston Ltd. (i.e. Loblaws).

**Cost of debt.** Empire’s long-term liabilities, including the current portion of long-term debt, consist of the following:

|  |  |
| --- | --- |
| **Instrument** | **Book Value (CAD millions)** |
| First mortgage loans, weighted average interest rate 5.84%, due 2021-2033 | 5.8 |
| Medium-term notes, Series D, interest rate 6.06%, due October 29, 2035 | 175.0 |
| Medium-term notes, Series E, interest rate 5.79%, due October 6, 2036 | 125.0 |
| Medium-term notes, Series F, interest rate 6.64%, due June 7, 2040 | 150.0 |
| Series 2013-2 notes, interest rate 4.70%, due August 8, 2023 | 500.0 |
| Notes payable and other debt primarily at interest rates fluctuating with the prime rate | 140.4 |
| Credit facility, expiring November 4, 2020, floating rate tied to bankers’ acceptance rates | 500.0 |
| Credit facility, expiring December 10, 2020, floating rate tied to bankers’ acceptance rates | 400.0 |
| Lease obligations | 29.1 |
| Total long-term liabilities | 2,025.3 |

Current market rates and fair market values for each debt instrument could not be determined due to limited disclosures in Empire’s annual report. Also, all notes were issued using private placements so bond market quotations were not available. Interest expense on long-term liabilities was reported at CAD 86.5 million, so the cost of debt was estimated to be 4.27% by dividing this cost by total long-term liabilities. Empire’s marginal tax rate was 27.7%, so the after-tax cost of debt was estimated to be 3.09%.

Another approach would be to establish a corporate yield curve for other firms with the same credit rating and then prorate these interest rates using the book value of the company’s debt at each maturity. Empire has a BB+ credit rating with Standard & Poor’s.

**Weights.** Empire had a dual-class share structure consisting of 173,661,495 non-voting Class A shares and 98,138,079 Class B shares that traded at CAD 29.75 for a total market value of CAD 8,086.0 million. No preferred shares were outstanding. Assuming that the book value of the debt approximates its market value, the debt and equity weights were:

Debt weight = = .20

Common equity weight = = .80

**WACC.** Empire’s WACC was estimated to be:

(.0650) (.80) + (.0309) (.20) = .0582 or 5.82%

Duff & Phelps inputs are calculated using U.S. data, but given the integrated nature of the Canadian and U.S. economies and similar attitudes towards risk in the two countries, this was felt to be appropriate.

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1Baker, H., Dutta, S., Saadi, S. (2011). Corporate Finance Practices in Canada: Where Do We Stand? *Multinational Finance Journal*, vol. 15, no. 3/4, 157-192.

1 Formula proof

Modigliani-Miller with corporate taxes states:

VL = Value of the levered firm

VU = Value of the unlevered firm

D = Debt value

E = Equity value

T = Tax rate

VL = VU + T × D

D + E = VL

So, D + E = VU + T × D.

Each side of the formula represents the value of the levered firm. The weighted average risk measures or betas for each side of the formula must be equal. So, the formula is:

Multiplying both sides by VL, the formula is:

Isolating for BL, the formula is:

Substituting for , the formula is:

+ T

Substituting in (D + E = VL) and multiplying by , the formula is:

Simplifying, the formula is:

Assuming BD = 0, the formula is: