

# Understanding the Postulates of the Capital Asset Pricing Model

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*The capital asset pricing model (CAPM) is a widely accepted model for estimating the cost of equity capital. The simplicity of the model and the relative availability of model inputs make CAPM an attractive tool for estimating the cost of equity capital. However, it is important for the valuation analyst (1) to understand the many postulates that are essential presuppositions to the CAPM and (2) to apply the necessary adjustments when valuing taxpayer properties for property tax purposes. This discussion summarizes the relevant premises in the CAPM and the adjustments that the valuation analyst should consider when using CAPM in the valuation of taxpayer properties for property tax purposes.*

## INTRODUCTION

The valuation analyst will often use the income approach to value the taxpayer company operating assets. One important component in the income approach is the selection of the appropriate present value discount rate. The present value discount rate should consider

1. the time value of money and
2. the perceived risk of the cash flows.

The present value discount rate for a discounted cash flow (DCF) analysis is often calculated using the weighted average cost of capital (WACC). The WACC is comprised of (1) a required rate of return on debt (the “debt rate”) and (2) a required rate of return on equity (the “equity rate”).

The WACC represents the weighted average of the cost of each of the components in the taxpayer’s capital structure (i.e., debt capital and equity capital). These capital costs, expressed as required rates of return, are weighted according to the analysis of the capital structure of the taxpayer corporation and the taxpayer industry.

The debt rate is relatively simple to estimate. It is the after-tax cost of debt capital. The long-term

debt cost of the taxpayer corporation can often be estimated by

1. analyzing the cost of the taxpayer debt or
2. relying on some economic benchmark, for instance the bank prime interest rate as of the valuation date.

Once the appropriate long-term debt cost is selected, the debt cost may be tax affected by the taxpayer corporation income tax rate.

The equity rate is more complicated to estimate. Many models provide guidance on developing the equity rate. One widely accepted model used to develop the equity rate is the capital asset pricing model (CAPM).<sup>1</sup>

The CAPM was developed in the 1960s, and it has been used ever since in the estimation of the equity rate. Many valuation analysts rely on the CAPM to estimate the equity rate. However, relying on the CAPM leads to acceptance of its underlying postulates. Not understanding these underlying presuppositions of the CAPM can lead to the model’s misuse for valuation purposes.

This discussion describes the foundational premises supporting the CAPM. This discussion considers adjustments to apply to the CAPM analysis when

estimating a present value discount rate for the purposes of valuing the taxpayer assets by preparing a unit principle valuation.

## CAPM OVERVIEW

Many financial and valuation textbooks discuss aspects of the CAPM extensively. The focus of this discussion is to understand the basic concepts of the CAPM and their application in the valuation of the taxpayer assets. Therefore, this discussion only includes a simplified description of the CAPM. Furthermore, any reference to the CAPM in this discussion is for the traditional (not the modified) version of the CAPM.<sup>2</sup>

In order to understand the components of the CAPM, it is useful to start with a definition.

In *Corporate Finance*, the authors define the CAPM as follows:

The CAPM is an equilibrium asset pricing theory that shows that equilibrium rates of expected return on all risky assets are function of their covariance with the market portfolio.<sup>3</sup>

Similarly, in *Investments*, the definition of the CAPM is stated as:

The CAPM is an equilibrium model of asset pricing that states that the expected return on a security is a positive linear function of the security's sensitivity to changes in the market portfolio's return.<sup>4</sup>

Simply stated, the CAPM reflects the relationship between a certain type of risk and expected return. Investors require a higher return for an investment in risky assets and a lower return for an investment in less risky assets. The CAPM was developed using the assumption of a diversified market portfolio.

The market portfolio includes all types of risky securities. The market portfolio is perfectly diversified. In addition, both definitions allude to the relationship between each individual security and the market portfolio.

This is an essential foundational concept of the CAPM. In a typical taxpayer corporation, the assets of the corporation are not included in a perfectly diversified portfolio. Instead, the taxpayer corporation assets are typically concentrated in one industry and one company.

The CAPM formula for estimating the equity rate—or cost of equity capital—is presented as follows:

$$K_e = R_f + [\beta (E_{RP})]$$

where:  $K_e$  = Cost of equity capital  
 $R_f$  = Risk-free rate of return  
 $\beta$  = Selected beta for the subject security  
 $E_{RP}$  = Market-derived equity risk premium

The CAPM formula can be separated into three main components: (1) the risk-free rate, (2) the market-derived equity risk premium, and (3) the selected beta.

The first CAPM formula component, the risk-free rate, reflects the minimum return the investor expects to receive from his or her investment. This rate reflects the time value of money, and it incorporates:

1. the investors' expectations for the real rate of interest on money and
2. the impact of inflation over time.

Simply, it is the reward the investor expects to receive for the inability to spend his money today.

The second CAPM component, the market-derived equity risk premium, is the market return that an investor can expect over the risk-free rate by investing in the market portfolio.

As previously mentioned, the market portfolio

1. consists of a fully diversified bundle of perfectly liquid securities and
2. is the same for all investors.

The third CAPM component, the beta, indicates the subject security's sensitivity to the market. This variable calculates the amount of expected systematic risk, or market risk, for that security.

These three components collectively compensate the investor for the assumed risk he or she takes by investing in a certain security. The traditional CAPM does not compensate the investor for total risk. Total risk includes

1. systematic, or market, risks and
2. unsystematic, or asset-specific, risks.

Systematic risks are unanticipated economy-wide events that affect almost all assets to some degree. Unsystematic risks are unanticipated events that affect single assets or small groups of assets.

The recent global recession is an example of a systematic risk, because its effects were economy wide and it affected many assets in unrelated industries.

Labor issues or a bad earnings report specific to a corporation are examples of unsystematic risk.

Because the risk of the security is measured based on its relationship to the diversified portfolio, the CAPM assumes that the unsystematic risks are diversified away. Therefore, in the CAPM, the investor is only compensated for systematic risk.

## CAPM POSTULATES

It is often necessary to make foundational postulates in order for any theoretical model to work. However, it is also important to understand these essential premises to determine if that model is appropriate for the issue at hand.

Milton Friedman, a prominent economist, stated the following about assumptions in his *Essays in the Theory of Positive Economics*:

The relevant question to ask about the “assumptions” of a theory is not whether they are descriptively “realistic,” for they never are, but whether they are sufficiently good approximations for the purpose in hand. And this question can be answered only by seeing whether the theory works, which means whether it yields sufficiently accurate predictions.<sup>5</sup>

As the quote implies, it is important to understand whether the assumptions work for the purpose at hand. In our case, it is important to fully comprehend the presuppositions behind CAPM in order to recognize whether they are applicable for property tax valuation purposes.

Furthermore, understanding these presuppositions allows the valuation analyst to modify or adjust the equity rate to reflect any additional risk that the taxpayer corporation or assets may have.

There are several fundamental postulates inherent in the CAPM. By using the CAPM in the estimation of the equity rate, the valuation analyst accepts these postulates to be true in his or her analysis.

The fundamental postulates included in the CAPM are as follows:

1. Investors operate in a perfect market where information is freely and instantly available to all investors.
2. Investors evaluate portfolios by looking at expected returns and standard deviations of the portfolios over a one-period horizon.
3. Investors are risk-averse.
4. Individual assets are infinitely divisible.

5. Investor may lend or borrow money at the risk-free rate, and the risk-free rate is the same for all investors.
6. All investors have the same one-period time horizon.
7. There are no transaction costs or income taxes.

More broadly, the CAPM is based on these presuppositions:

1. All investors have the same expectations towards investments.
2. All investors agree on the risk and performance of individual securities.

Essentially, the CAPM assumes that, in a perfect market where there are no restrictions on investments (i.e. income taxes, transaction costs, etc.), all investors will have the same information, at the same time, and will invest in a similar manner.

Of course, in the real world, this is far from the truth. While this simplified premise of the perfect world allows the CAPM to estimate the riskiness of a security, it is important for the valuation analyst to understand these postulates when applying the CAPM to value a company or an asset in the real world. This lack of a perfect market may indicate additional risk for the investor.

It is important to understand that the CAPM was created to estimate returns for market securities. However, the characteristics of the market securities are fundamentally different from the characteristics of the taxpayer corporation operating assets.

The taxpayer corporation assets typically

1. are not traded in a public market,
2. have limited financial information available,
3. require a large dollar investment compared to the overall investor portfolio,
4. are typically concentrated in one industry (not diversified), and
5. require a long-term investment.

Each of these risk factors is not contemplated by the CAPM. And, each of these risk factors should be considered in a separate analysis when building a present value discount rate for the subject taxpayer corporation. One way that a valuation analyst can consider additional risks for the subject taxpayer corporation is through the application of the company-specific equity risk premium.

The transaction markets where the public securities trade are significantly different from the markets in which the taxpayer corporation assets would trade.

The transaction market for the taxpayer corporation assets typically

1. is undeveloped and unorganized,
2. has few buyers concentrated in a specific location,
3. has unpredictable and high transaction costs,
4. is highly regulated,
5. has volatile supply and demand,
6. has delayed and limited information, and
7. has uninformed investors.

The unorganized nature of the taxpayer transaction market coupled with the unique characteristics of the taxpayer assets would cause an investor to expect a higher rate of return for investing in these particular assets.

By assuming a perfect world, where all investors have the same information, make the same decisions, and invest in a perfectly diversified portfolio, the CAPM is excluding certain risks from the equity rate calculation.

## CAPM MODIFICATIONS

While many financial textbooks discuss the CAPM in detail, many valuation textbooks and publications discuss the adjustments that are necessary to CAPM for valuation purposes.

It is common for the valuation analyst to modify the CAPM in order to adjust the cost of equity for

1. small size risk and
2. unsystematic risk, or company-specific risk.

In *Cost of Capital: Applications and Examples*, a suggested expanded CAPM is presented.

The formula for the expanded CAPM is as follows:

$$K_e = R_f + [\beta (E_{RP})] + RP_s + RP_u$$

where:

$RP_s$  = equity risk premium for small size

$RP_u$  = equity risk premium attributable to the specific company

The small size equity risk premium and the company-specific equity risk premium represent the unsystematic risk that is not included in the CAPM. While there are ample qualitative reasons why the unsystematic risk should be included in the CAPM, the quantification of the risk is complex and requires professional judgment.

## Small Size Equity Risk Premium

There is a substantial amount of research that indicates that, on average, small stocks outperform large stocks.

The *Ibbotson SBBI 2011 Valuation Yearbook* (the *SBBI Yearbook*) addresses the need to quantify the additional risk demanded by small companies: “The need for [size] premium when using the CAPM arises because, even after adjusting for the systematic (beta) risk of small stocks, they outperform large stocks.

The betas for small companies tend to be greater than those for large companies. However, these higher betas do not account for all of the risks faced by those who invest in small companies.”<sup>6</sup>

The *SBBI Yearbook* groups companies traded on the New York Stock Exchange (NYSE), the Nasdaq National Market (Nasdaq), and NYSE Amex Equities (AMEX) in 10 deciles ranked from largest to smallest based on the market capitalization of the companies. For each of the 10 deciles, the *SBBI Yearbook* provides a return in excess of CAPM, or the size premium. These returns are presented in the *SBBI Yearbook* and are updated annually.

Additional support for the small size equity risk premium is the *Duff & Phelps, LLC Risk Premium Report* (the “Duff Report”).

The authors of the Duff Report quantify the relationship between rates of return, company size, and fundamental measures of company risk by (1) sorting companies traded on the NYSE into 25 size-ranked portfolios and then (2) adding the companies traded on the Nasdaq and AMEX.

The Duff Report provides a source of estimating the size premium in excess of the CAPM. Furthermore, the Duff Report provides an alternative source of estimating the required cost of equity. The Duff Report is also updated on an annual basis.

The *SBBI Yearbook* data and the Duff Report data provide guidance for the quantification of additional risk not captured in the CAPM, particularly

### Further Reading

Shannon P. Pratt and Roger J. Grabowski. *Cost of Capital: Applications and Examples*, 4th ed. (New York: John Wiley & Sons, 2010).

the risk related to the attributes of the smaller companies. However, the small stock risk premium does not capture all of the additional risks of the subject taxpayer corporation.

Both publications caution that consideration of additional risk is necessary, depending on the subject company's risk characteristics. These additional risks can be quantified in the company-specific equity risk premium.

## Company-Specific Equity Risk Premium

Due to the nature of the company-specific risks, it is difficult to quantify these risks uniformly for every company. Instead, the valuation analyst should use professional judgment to estimate the company-specific equity risk premium.

There are several published guidelines for estimating this risk.

Presented below is a brief discussion of commonly used factors and models for estimation of the company-specific equity risk premium.

### The Black/Green Factors

Parnell Black and Robert Green suggest a set of company-specific risk factors summarized in the following categories:

1. Competition
2. Financial strength
3. Management ability and depth
4. Profitability and stability of earnings
5. National economic effects
6. Local economic effects

Black and Green suggest assigning a point value to these factors in order to quantify the company-specific equity risk premium.<sup>8</sup>

### The Tri-Level Unsystematic Risk Framework

Warren E. Miller uses a competitive advantage/strategic analysis structure for estimating the appropriate company-specific equity risk premium. Specifically, Miller uses the Tri-Level Unsystematic Risk Framework. This framework relies on the

Strategy, People, Architecture, Routines, and Culture (SPARC) analysis of the subject company.

The Tri-Level Unsystematic Risk Framework includes three categories:

1. Macroeconomy
2. Domain (industry)
3. Company

Miller notes that the analysis of unsystematic risk is a top down procedure, as it starts at the broadest level, or the macroeconomy, and gradually narrows down to the subject company. Miller suggests that valuation analysts understand the subject company by analyzing each of the five components of SPARC when estimating the company-specific equity risk premium.<sup>9</sup>

### The Gary Trugman Factors

In *Understanding Business Valuation*, Gary R. Trugman presents individual company-specific equity risk premium factors for valuation analyst's consideration.<sup>10</sup>

Trugman suggests the analysis of the following risk factors:

1. Economy risk
2. Operating risk
3. Asset risk
4. Market risk
5. Regulatory risk
6. Business risk
7. Financial risk
8. Product risk
9. Technological risk
10. Legal risk

When comparing the subject company to its industry group, Trugman suggests that the analyst consider the following factors:

1. Economic conditions
2. Location of business
3. Depth of management
4. Barriers to entry into market
5. Industry conditions

### Further Reading

Timothy J. Meinhart. "Estimating a Company-Specific Risk Premium in the Cost of Capital for Ad Valorem Tax Valuation Purposes." *Willamette Management Associates Insights* (Summer 2008).

6. Competition
7. Quality of management
8. The bottom line

Trugman cautions the valuation analyst that, when developing the company-specific equity risk premium, the ultimate answer has to make sense in the overall valuation analysis.

### The Finison/Dailey Model

E. Bryant Finison Jr. and Michael L. Dailey provide a model for estimating company-specific equity risk premium based on a SWOT analysis. Finison and Dailey use a five-point scale to quantify the company-specific equity risk premium.

The strength/weakness scale ranges from negative two for “critical weakness” to positive two representing “core competence.” The opportunity/threat scale ranges from negative two for “very threatening” to positive two for “very opportunistic.” The Finison/Daily Model provides a formula to pinpoint the company-specific equity risk premium.<sup>11</sup>

The Finison/Daily model provides a structured approach to estimating company-specific equity risk premium.

However, within the Finison/Dailey Model, the valuation analyst should still use his or her professional judgment in determining the appropriate analysis area and ratings.<sup>12</sup>

### The Butler Pinkerton Model

Peter Butler and Keith Pinkerton suggest quantifying company-specific equity risk premium for publicly traded comparable companies, which can then be used to select a company-specific risk for a privately held company.

Butler/Pinkerton suggest measuring the comparable companies’ total beta. Total beta measures a stock’s riskiness relative to the market, including size and company-specific risk.

According to Butler/Pinkerton, the total beta of the stock can be calculated using the stock’s beta and the correlation coefficient between the stock and the market.

Once the valuation analyst calculates the total beta, then the valuation analyst can calculate the company-specific equity risk premium for each comparable company using the following components:

1. The total beta
2. The company’s beta
3. The general equity risk premium
4. The size equity risk premium<sup>13</sup>

The Butler/Pinkerton model provides the valuation analyst additional quantitative support in estimating the company-specific equity risk premium. However, the valuation analyst still has to use professional judgment when comparing (1) the subject company to (2) the company-specific equity risk premium of the publicly-traded comparable companies.

Each of these factors and models provides guidelines for valuation analysts for estimating company-specific risk. In addition, they provide support for unsystematic risk present in individual corporations subject to valuation.

These models recognize the need to quantify the risks related to these company-specific factors and properly adjust the discount rate to reflect these additional risks.

The small size equity risk premium and the company-specific equity risk premium consider some of the unsystematic risk of the taxpayer corporation assets that is not estimated by the CAPM. While quantifying the unsystematic risk in the CAPM can be a daunting task for the valuation analyst, it is a necessary procedure.

The CAPM is a tool that is a helpful starting point in developing the cost of equity capital. However, it is not the ending point in that analysis.

The valuation analyst should understand the risks of the taxpayer corporation in order to fully measure the return that an investor would expect from the investment.

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## SUMMARY AND CONCLUSION

The CAPM is a widely accepted model for estimating the cost of equity capital. Many valuation analysts use the CAPM in building the present value discount rate to use in an income approach analysis.

The income approach is then used to estimate a value for the unit of the taxpayer company total assets. However, it is important for the valuation analyst to understand that the CAPM—much like many financial models—is only a starting point for each analysis.

Based on the facts and circumstances of the taxpayer company assets, adjustments may be necessary to the CAPM formula. Absent these adjustments, the concluded value for the taxpayer total assets may not reflect the fair market value of the taxpayer company total assets.

The size equity risk premium and the company-specific equity risk premium capture some of the risks not contemplated by the CAPM. The quantification of these risks (1) addresses the specific nature of the taxpayer assets and (2) mitigates some of the issues caused by the CAPM.

It is important for the valuation analyst to remember that a present value discount rate is ultimately an estimate of an expected return. While there are models available to develop various components of the discount rate, it is important that the valuation analyst (1) use his or her professional judgment and (2) make sure that the present value discount rate conclusion makes sense for the taxpayer company total assets.

Notes:

1. Other models often used to estimate the equity rate include (1) the build-up model, (2) Duff & Phelps, LLC Risk Premium Report Model, (3) dividend yield plus capital gain yield model, (4) arbitrage pricing theory model, and (5) Fama-French three-factor model.
2. Additional references for the CAPM can be found in: Harry Markowitz, "Portfolio Selection," *The Journal of Finance* 7, no. 1. (March 1952): 77–91; William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *The Journal of Finance* 19, no. 3 (September 1964): 425–442; Jan Mossin, "Equilibrium in a Capital Asset Market," *Econometrica* 34, no. 4. (October 1966): 768–783; John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *The Review of Economics and Statistics* 47, no. 1. (February 1965): 13–37; and financial and investment textbooks.
3. Stephen A. Ross, Randolph W. Westerfield, and Jeffery J. Jaffe, *Corporate Finance*, 3rd edition (Homewood, IL: Richard D. Irwin, Inc., 1993), G3.

4. William F. Sharpe, Gordon J. Alexander, and Jeffery V. Bailey, *Investments*, 6th edition (Upper Saddle River, NJ: Prentice Hall, Inc., 1999): 908.
5. *Essays in the Theory of Positive Economics* (Chicago: University of Chicago Press, 1953): 9.
6. *Ibbotson S&P 500 Valuation Yearbook* (Chicago: Morningstar, Inc., 2011): 44-45.
7. Formerly known as the American Stock Exchange.
8. The Black/Green factors are described in various National Association of Certified Valuation Analysts (NACVA) publications and training materials, including the 2008 NACVA publication *Business Valuations: Fundamentals, Techniques and Theory*.
9. Warren D. Miller, *A Tri-Level Framework for Analyzing and Quantifying Unsystematic Risk* (Lexington, VA: Beckmill Research, 2008).
10. Gary R. Trugman, *Understanding Business Valuation*, 3rd ed. (New York: American Institute of Certified Public Accountants, 2008), 367-373.
11. The formula for the Finison/Daily Model is as follows:  $P^{CS} = C - (\sum(SW\%, OT\%) \times (R^{max} - R^{min})/4)$  where  $P^{CS}$  = company-specific risk premium, C = center point of premium range, determined by averaging  $R^{max}$  and  $R^{min}$ , SW% = the percentage score of Strengths and Weaknesses, OT% = the percentage score of Opportunities and Threats,  $R^{max}$  = the maximum possible premium in the range, and  $R^{min}$  = the minimum possible premium in the range.
12. The Finison/Dailey Model is described in E. Bryant Finison Jr. and Michael L. Dailey, "A SWOT Model for Quantifying the Company-Specific Risk Premium," *Business Valuation Update* (July 2003).
13. The formula for the Butler Pinkerton Model is as follows:  $CRSP = (T_{\beta} * ERP) - (\beta * ERP) - SP$ , where CRSP = company-specific equity risk premium,  $T_{\beta}$  = total beta, ERP = equity risk premium,  $\beta$  = company beta, and SP = size premium.
14. The Butler Pinkerton Model is described in Peter J. Butler and Keith A. Pinkerton, "Quantifying Company-Specific Risk: A New, Empirical Framework With Practical Applications," *Business Valuation Update* (February 2007).

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