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AN IMPROVED METHOD FOR ESTIMATING DISCOUNT RATES FOR LISTED COMPANY VALUATION

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ABSTRACT

This study offers a comprehensive overview of estimation methods for the discount rate used in company valuation, and then attempts to improve these methods. Firstly, for the cost of equity estimation method, this study improves the traditional form of build-up model by replacing its size premium with a beta-adjusted size premium, so that the size premiums for firms in different size groups can be better reflected. Next, the study introduces an expanded capital asset pricing model (CAPM) which replaces the ordinary least square (OLS) beta with a shrunk beta. The beta-adjusted average size premium and the firm-specific risk premium were also added to capture unsystematic risk not measured by the traditional CAPM. In addition, this study introduces a target price-based multi-stage Gordon growth model, which adapts the consensus target price as a proxy of the intrinsic value in a manner consistent with the assumption of the basic Gordon growth model. The study continues by offering an effective solution to the estimation of cost of debt for companies above and below investment grade. The marginal tax rate and the forecasted rate on new debt issuance are recommended when estimate cost of debt. Finally, the study suggests a forward-looking target capital structure to combine the cost of equity and cost of debt. The approach involves a three-step process to identify the possible target structure that firms are likely to adopt in the long term.

JEL: G12, G14, C10

KEYWORDS: Discount Rate, Cost of Capital, Company Valuation

INTRODUCTION

Determination of the appropriate discount rate for different companies is one of most challenging works in valuation. This hold especially true in private business valuation where many essential inputs in the cost of capital estimation cannot be observed directly. Relative valuation models, such as price and enterprise value multiples, disclose the intrinsic value of a company on the basis of comparable firms. For these models no discount rate is required. However absolute models rely heavily on the discount rate. Absolute models are commonly over-sensitive to the changes in estimated inputs such as the rate used to discount future cash flows. This occurs because for many companies, especially high growth companies, the estimated terminal value in absolute valuation usually accounts for a large percent of total estimated value. Therefore, estimating an accurate discount rate to fully reflect both the time value of money and the uncertainty of future cash flows is essential to produce reliable valuation results.

Although literature on valuation models exists, this practice-oriented study aims to improve the existing discount rate estimation methods for listed company valuation purposes. This study focuses on the estimation of weighted average cost of capital (WACC), which represents the overall required return on a company's entire capital (equity and debt). The WACC has often been used as a discount rate in free cash flow to the firm valuation. The WACC contains three parts: the cost of equity, after tax cost of debt and target capital structure.

The rest of the study is organized as follows: The literature review section provides a general overview of the discount rate estimation in company valuation. The next section discusses the existing estimation method of WACC followed by the improved WACC estimation method introduced by this study. The paper continues by presenting the existing methods for the estimation key components of WACC such as risk-free rate, beta and equity market premium. Lastly, the paper closes with some concluding comments.

LITERATURE REVIEW

The discount rate is widely used in company valuation to estimate the intrinsic value of company. It is an important component of any absolute valuation models such as the discount cash flow and adjusted present value models. Pratt (2002) states that the discount rate reflects both the time value of money and the risk of expected future cash flows. In valuation practice, the cost of capital of a company has often been used as a discount rate that equates expected economic income with present value. The cost of capital is a forward-looking rate required by the market to attract funds or maintain a current market price level. It consists of the risk-free rate and a variety of risk premiums to reflect t market expectations about the real rate of return, expected inflation and risks (Pratt, 2002). The discount rate must be defined correspondingly in relation to the type of cash flow being discounted. For example, the required return on equity is an appropriate discount rate for the dividend and free cash flows to equity. The free cash flow to the firm only can be discounted by utilizing the weighted average cost of capital (WACC).

Although the capital structure and source vary significantly across different companies, equity and debt are two major sources of financing. Therefore, the cost of capital may refer to the required return on a company's equity capital or debt capital, or both (the weighted average cost of capital). However, no matter the type of capital resources used, the cost of capital must be measured in market value and normally in nominal terms except in the rare situation of unpredictable hyperinflation.

Some confusion can result from the terms required return and expected return which are sometimes used interchangeably. Pinto et al. (2009) argue that the required return is the hurdle rate or minimum level of expected return that the market required, and they can only be used interchangeably when the company is efficiently priced. The authors further point out that although individual investors can form different expectations (expected returns) about the future dividend yield and price appreciation, the required return used to discount future economic income of a company is market driven rather than a personal required return.

Analysts rarely accept any estimated discount rate at face value. Rather, they adjust it based on several factors. Based on a survey conducted by the Association for Financial Professionals (AFP) with more than 300 top financial officers, Jacobs and Shivdasani (2012) conclude that nearly half the respondents admitted that discount rates they use are likely to be at least 1% above or below the company's true rate.

EXISTING METHODS FOR ESTIMATING WEIGHTED AVERAGE COST OF CAPITAL

Cost of Equity

The cost of equity is the rate of return that markets demand in exchange for owning asset and bearing ownership risk, it is an important component of the weighted average cost of capital (WACC). The cost of equity can be directly used as a discount rate for certain valuation model such as the discount dividend model. Normally, a company's equity capital consists of common stock (includes additional paid-in capital and retained earnings) and preferred stock (includes the hybrid security such as convertible preferred stock). Both sources need to be taken into account when estimating the cost of equity. Koller et al. (2010) state that the cost of equity is determined by three factors: the risk-free rate, the market wide risk premium and a risk adjustment factor that reflects each company's riskiness relative to its peers. A wide range of cost of equity estimation techniques have been developed, and the following sections provide comprehensive overview of these methods.

Build-Up Model: The build-up model is a traditional but widely used multifactor model to estimate the required return on equity capital, especially for small listed companies or private businesses. Pratt (2002) states that the build-up method estimates the cost of equity as the sum of the risk-free rate and a series of risk premiums. Usually the premiums for risk include the equity market premium, size premium, perceived company-specific risk premium and possibly the industry premium and illiquidity premium. In addition, the country-specific premium sometime needs to be considered but it is not required in developed markets such as the United States. The build-up model is ideal for small companies. As Pinto et al. (2009) indicate the sum of risk-free rate and equity market premium is actually the average required return on large-cap listed equity plus an incremental small size premium to reflect the average required return on micro-cap listed equity. Finally, the premium to represent the company-specific risk is added to arrive at the cost of equity for a particular small company. However, application of the traditional build-up model form needs to judge the types of risk premium on a case-by-case basis. This process can be over-complicated when the model contains many premiums each of which must be estimated. Fortunately, there is a simple and convenient form of build-up model available, known as the bond yield plus risk premium model (BYPRP). Pinto et al. (2009) state that the BYPRP is suitable for companies with public traded debt. This model estimates the cost of equity roughly as the sum of the yield to maturity on a company's long-term debt and a risk premium. The authors further indicate the risk premium in this model is aimed to compensate for the additional risk of equity issues compared with debt issues. The risk premium is usually within 3 to 4 percent in the United States.

Capital Asset Pricing Model (CAPM) : The CAPM is a popular single-factor model to estimate the cost of equity for larger listed firms. The model is based on strong theoretical foundation and is easy to apply. According to the AFP survey, Jacobs and Shivdasani (2012) conclude that about 90% of respondents select the CAPM model as their primary tool to estimate cost of equity. The CAPM builds on the assumption that capital markets have four major type of risk: inflation, maturity, systematic and unsystematic risks. The unsystematic risk of individual stock can be easily diversified away in a large and well-diversified portfolio (Pratt, 2002). Therefore, the CAPM only considers the inflation and maturity/interest risks as captured by the risk-free rate, and the systematic risk as measured by the market risk premium. The CAPM measures each stock's riskiness relative to the whole market by the beta risk adjustment factor. However, there are doubts concerning the CAPM as many studies argue it describes risk incompletely. For example, Pinto et al. (2009) state that in reality, the coefficients of determination (R2) for individual stocks' beta regressions usually range from 2 percent to 40 percent, with many under 10 percent.

Gordon Growth Model (GGM): The GGM is also a popular estimation method for the required return on equity due to its forward-looking, simple and direct features. Some studies argue that GGM tends to produce lower cost of equity figures than build-up and CAPM approaches. The GGM is completely different from the single-factor or multifactor models and it has two forms: single-stage and multi-stage.

The single-stage GGM assumes a constant growth rate and estimates the cost of equity as the sum of dividend yield and the dividend growth rate of the firm. The dividend or earnings growth rate must be based on the long-term (5 to 10 year) consensus rate rather than the short-term rate to reflect the steady-state growth after a finite forecast horizon. In addition, Pratt (2002) states that the GGM assumes the current market price equals the expected future returns discounted to a present value at a discount rate that represents the cost of equity capital for the company. Thus, the dividend yield is calculated as the year-ahead aggregate forecasted dividend divided by the intrinsic value per share of the firm. However, analysts tend to use the market price to calculate the dividend yield when applying the GGM to estimate the cost of equity. This produces a market price-implied cost of equity or discount rate, but this goes against the basic assumption of GGM when the mispricing exists.

The implied required return on equity only can be used as a discount rate when the firm is fairly priced. Fitzgerald et al. (2011) argue that the use of market price in the GGM to calculate the discount rate results in an estimated cost of equity that often underestimates the realized cost of equity capital. Another issue in the application of GGM is that not all firms make regular cash dividends. Technology firms in the high growth stage tend to retain earnings for reinvestment. Pratt (2002) recommends defining the "dividend" broadly and introduce a net cash flow to equity (NCFE) as an alternative. The author defines the NCFE as those amounts of net cash flows that could be paid to equity investors without impeding a company's future growth (NCFE = Net income + Noncash charge - Capital expenditure - Additions to net working capital ± Changes in long-term debt). Koller et al. (2010) suggest the cash flow available to equity holder (CFAEH) as another alternative choice to replace the dividend (CFAEH = Earnings*(1- Long term Real Gross Domestic Product grow rate/Long term Return on Equity)).

On the other hand, rather than assume a constant earnings growth rate for the entire lifetime of a firm, the multi-stage GGM incorporates different growth rates at different stages of a firm. This is more reasonable, especially for rapid growing firms. Normally, the multi-stage GGM has two or three stages, and each stage lasts about three to five years. The three stages GGM is more logical as it contains a smooth transition from growth to maturity. Pinto et al. (2009) divide the lifetime of a firm into three stages: growth, transition and mature, and estimate a cost of equity that equates the sum of the present values of the expected cash flows of the three stages to the current market price.

Other Cost of Equity Estimation Methods: In addition to the above equity capital cost estimation techniques, there are many other methods available. Although these methods are less frequently used than the CAPM, they are supplementary to the analyst's toolkit. The multifactor Fama-French model is perhaps the most famous empirical evidence-based model. It is different from the CAPM due to how it defines risk. Koller et al. (2010) states the CAPM defines a stock's risk as its sensitivity to the stock market, whereas the Fama-French three-factor model defines risk as a stock's sensitivity to the market, size and value portfolios. Another multifactor, Pastor-Stambaugh model, adds a fourth factor (liquidity) to the Fama-French Model. This approach represents the excess returns to a portfolio that invests the proceeds from shorting high-liquidity stocks in a portfolio of low-liquidity stocks (Pinto et al., 2009). The liquidity factor usually depends on the size of the interest and the depth and breadth of the market, and also its ability to absorb a block without an adverse price impact. Besides, rather than rely on the fundamental factors of firms to estimate the cost of equity, the macroeconomic model considers economic variables (e.g. business cycle, market timing) that affect the expected future cash flows of companies. The statistical cost of equity estimation methods adapts the historical returns to determine portfolios of factors explain return variation.

Cost of Debt

Cost of debt reflects the average after-tax interest rate that a company pays on its overall debt and is an important component of the WACC. Unlike the government securities, the corporate bond contains a certain degree of default risk especially for companies below investment grade (lower than S&P BBB- credit rating). Thus, the after-tax yield on corporate bonds is determined by the cost of debt, default risk premium and recovery premium. Specifically, recovery premium is influenced by the recovery rate after default. Koller et al. (2010) indicates the default risk premium is largely affected by company's bond rating and amount of collateral, and it relates to a series of factors such as leverage, profitability and the sensitivity of profitability to systemic risk which could influence the company's probability of default (Pinto et al., 2009).

For companies with investment grade debt, the after-tax yield to maturity (YTM) or yield to call (YTC) on the company's liquid, option-free and long-term public traded debt has often been selected as a proxy for cost of debt. The YTM or YTC can be calculated based on the market price of a bond and promised cash flows, or use the credit rating to estimate them if the company only has short term bonds or bonds trade infrequently. In particular, determining a company's credit rating on unsecured long-term debt, and then examining the average yield on a portfolio of long-term bonds with the same credit rating. Pratt (2002) recommends YTM when the stated interest rate is below the current market rate, otherwise, YTC is preferred. In addition, although over 64% of respondents in the AFP survey choose the company's effective tax rate to estimate the after-tax yield, many studies argue that the marginal tax rate is the most appropriate rate. Pinto et al. (2009) stated the marginal tax rate is able to better reflect the firm's future cost of financing than the effective tax rate, where effective tax rate can reflect nonrecurring items. Moreover, Jacobs and Shivdasani (2012) suggest that when estimating the cost of debt, individuals should focus on the forecasted rate on new debt issuance rather than the current rate on outstanding debt or average historical rate.

It is not appropriate to using the YTM or YTC as a proxy for the cost of debt for companies below investment grade. This because the yield on corporate bonds may be significantly higher than the cost of debt, since the default risk premium and recovery premium are both large. Thus, Koller et al. (2010) suggest using absolute valuation models such as adjusted present value model and free cash flow to equity model, which are based on the cost of equity rather than the WACC to discount future economic incomes.

Capital Structure

Capital structure plays an important role in the determination of a company's WACC and it must on the basis of the market value of debt and equity. This is necessary because book value may significantly deviate from the market value and not reflect the true capital structure. In company valuation, the WACC discounts the expected cash flow from a company's entire lifetime and the WACC should base on the long-term sustainable capital structure. Thus, the forwarding-looking target weight has been frequently used to combine the cost of equity and debt capital. Pinto et al. (2009) indicates that target weight reflects the market expectations about target capital structure the company will tend to use over time. The target weight provides a good approximation when the current weight misrepresents the company's normal capital structure or the structure is expected to change in the future.

IMPROVED METHODS FOR ESTIMATING WEIGHTED AVERAGE COST OF CAPITAL

Cost of Equity

Improved Build-Up Model: This study improves the traditional build-up model by replacing its size premium with beta-adjusted size premium. Rather than applying the size premium, which is estimated by the arithmetic mean return difference between each size category and market index, Morningstar Ibbotson recommends the beta-adjusted size premium which is calculated by dividing NYSE listed firms into 11 size groups (from 1-largest to 10b-smallest) according to their market capitalizations, and each size group has its own average beta. The realized return in excess of what traditional capital asset pricing model (CAPM) estimates (by using the group-specific beta) is the beta-adjusted average size premium. The rational of this method is that the CAPM considers the systematic risk by beta, thus the difference between realized and estimated return is the unsystematic risk premium.

Improved CAPM Model: This study presents the expanded CAPM which is originally introduced by Pratt (2002) and Pinto et al. (2009) to better estimate the cost of equity especially for smaller firms. The general expression is given in equation (1) below.

$$Cost\ of\ Equity = Risk\ free\ rate + Shrunk\ beta * Market\ premium + SP + FP \quad (1)$$

Where: Shrunk beta = (1 – weight) * peer group beta + weight * company beta; Weight = (cross-sectional standard error)^2/[(cross-sectional standard error)^2 + (time series beta standard error)^2]; SP = Beta-adjusted average size premium; FP = Firm-specific risk premium.

The multifactor expanded CAPM is based on the fact that unsystematic risk cannot be fully diversified away especially for median and small cap firms, where total realized returns on smaller companies have been substantially greater than the CAPM would have predicted (Pratt, 2002). Thus, a beta-adjusted size premium is added to reflect the average level of incremental unsystematic risk that smaller firms over larger firms. In addition, the firm-specific risk premium which can be either positive or negative (more or less risky than the average level) is also included to capture the remining unsystematic risk. The estimation of firm-specific risk premiums depends on the subjective judgment of the firm and usually ranges from -2% to +2%.

Firms tend to close to industry average risk level in the long run so beta in the CAPM model should be more forwarding looking. Thus, the shrunk beta is recommended by Morningstar Ibbotson to replace the simple regression raw beta. Rather than adjust beta toward the mean value of one over the long run by Marshall Blume method (1971), shrunk beta is a more reasonable beta toward industry or peer mean value which is estimated by applying the Vasicek Shrinkage technique. In particular, firms with high raw beta or high standard error in their raw beta are subject to more adjustment toward the industry average level (Pratt, 2002).

Improved Gordon Growth Model: According to Pratt (2002) and Fitzgerald et al. (2011), this study introduces a target price-based multistage Gordon growth model (TPGGM) to estimate the discount rate. The general expression is given in equation (2). Note the life stage classification of a firm needs to be judged case-by-case. The TPGGM chooses the consensus target price as a proxy of the intrinsic value per share to consistent with the assumption of the basic Gordon Growth model, in case the market price deviates from the intrinsic value. Fitzgerald et al. (2011) show the target price-based estimate of cost of equity normally outperforms the market price-based estimate. Correlation between estimated and realized cost of equity is consistently positive and statistically significant when derived from target price. In addition, the TPGGM defines the cash flow differently across three stages to reflect the fact that firms in the latter stages tend to distribute earnings rather than retain it, the declining growth rates recommended by Morningstar Ibbotson are also in line with the characteristics of a firm over its lifetime.

$$\mathrm{TP} = \sum_{n=1}^{5} \frac{[\mathrm{CF}_0(1+\mathrm{g}_1)^n]}{(1+\mathrm{r})^n} + \sum_{n=6}^{10} \frac{\mathrm{CF}_5(1+\mathrm{g}_2)^{n-5}}{(1+\mathrm{r})^n} + \frac{\frac{\mathrm{CF}_{10}(1+\mathrm{g}_3)}{\mathrm{r}-\mathrm{g}_3}}{(1+r)^{10}} \tag{2}$$

Where: TP is analyst' consensus target price for the firm in the next 12 month time horizon; CF_0 is the cash flow in the preceding year (growth stage) = Net income + Noncash charge - Capital expenditure - Additions to net working capital ± Changes in long-term debt; CF_5 is the expected cash flow in the fifth year (transition stage) = Net income + Noncash charge - Capital expenditure - Additions to net working capital ± Changes in long-term debt; CF_{10} is the expected cash flow in the tenth year (mature stage) and it is equal to the dividend or Earnings * (1- Long term Real GDP grow rate / Long term ROE); g1, g2 and g3 are the expected cash flow growth rates in the three stages (g1 equals to the firm-specific growth rate, g2 equals to the industry average growth rate and g3 equals to the expected long-term GDP growth rate); r is the constant discount rate (cost of equity) for all the three stages.

Although the TPGGM assigns declining growth rates to three life stages of a firm respectively, it produces a constant cost of equity. The risk behind cash flows from differing stages of a firm should not the same, and the discount rate needs to reflect the underlying risk of each cash flow. Therefore, it is ideal if the discount rate is time-varying, with the cash flow from each stage being discount by its corresponding rate. However, this is not easy to implement in practice, and analyst tend to use a constant discount rate to all the future cash flows for simplicity. Recent studies provide great insight into the dynamic discount rate. Koller et al. (2010) state that if a company is near or already at its target capital structure (in mature stage), applying a constant weighted average cost of capital (WACC) or cost of equity leads a reasonable valuation result. For firms with expected significant change in capital structure, the authors agree that using a constant discount rate can lead to significant error. Davidson et al. (2013) show an apparent difference between the present value computed under the assumption of a fixed discount rate that lasts indefinitely into the future and present values determined by a time varying discount rate. Lyle and Wang (2013) also criticize the constant discount rate assumption in the Gordon Growth model arguing it can lead to significant valuation errors or poor investment decisions. However, the estimation of different discount rates for cash flows from the different stages of a firm is complex and subject to further study.

Cost of Debt

According to Koller et al. (2010) and Pinto et al. (2010), this study improves existing method and estimates the cost of debt separately. For companies with long-term public traded corporate bonds, the YTM on newly issued LT bonds has often been selected as a proxy of cost of debt. For companies with only short-term publicly traded corporate bonds (no LT credit rating), determine the possible LT credit rating and cost of debt by contrasting the key financial ratios with other firms (firms with LT credit ratings). For companies without publicly traded corporate bond (no credit rating), but with other form of debt such as bank loans, determine the possible LT credit rating and cost of debt by contrasting the key financial ratios with other firms (firms with LT credit ratings). For companies without any form of debt or liability at any time (rare), the cost of debt is zero

Capital Structure

This study presents the following improved target capital structure estimation method. For mature companies already at or near their target capital, the current market value of debt and equity can be directly used to estimate the target weight. For start-up or growth companies with unstable capital structure, Koller et al. (2010) recommend a three-step approach to find out the possible target structure that the companies are likely to adopt in the long term. The approach estimates the company's current market value-based capital structure, then judges the reasonableness of the estimated capital structure according to comparable companies and adjust it if necessary. Finally review management's implicit or explicit approach to financing and its impact on the target capital structure. It has often been found that the purpose of valuation has certain degrees of impact on the target structure. Pratt (2002) finds that valuation with minority interest has little influence, since it is beyond the power of minority stockholder to change the capital structure. However, the peer average or buyer's desired structure should be used to estimate target weight because the control buyer has the power to change the capital structure.

EXISTING METHODS FOR ESTIMATING OTHER KEY COMPONENTS OF WACC

Risk Free Rate

The risk-free rate is an important component of the traditional form of build-up model, equity market premium, capital asset pricing model (CAPM) and so on, the U.S. Constant Maturity rates of Treasury securities have often been selected as proxies. Treasury securities are normally free of default risk thus its yield consists of the real interest rate, expected inflation premium and maturity risk premium.

In terms of the maturity, Morningstar Ibbotson adopts the 30-day Treasury bill Constant Maturity rate as the risk-free rate to minimize the interest risk. Many studies argue that government bonds with longer maturities should be selected to comply with the going-concern assumption of valuation. Pinto et al. (2009) argue that a risk-free rate relative to long-term Treasury bonds should produce a more plausible discount rate in a multi-period context of valuation. Pratt (2002) states that a longer-term yield fluctuates significantly less than short term rate. Thus, a 20-year U.S. Treasury bond is preferred to avoid any short-term distortion into the actual cost of capital. However, Koller et al. (2010) argue that 20- or 30-year government bond is not a good proxy of the risk-free rate since it lacks liquidity and recommend the 10-year zero coupon note as a better choice. The 10 year Treasury note rate has been supported by recent studies and according to the AFP survey, Jacobs and Shivdasani (2012) conclude that about 46% of survey participants use the 10-year rate, 12% select the five-year rate and only about 4% survey participants use 20-year rate as the risk-rate.

Further, Koller et al. (2010) state it is ideal for each economic income to be discounted by a cost of capital derived from a Treasury security with the same duration or time horizon, but this is not easy to implement in practice. Therefore, the practical principle in valuation is to match the duration of the risk-free rate measure to the duration of company being valued (Pinto et al., 2009). Analysts often choose a Constant Maturity rate on Treasury notes to closely matches the entire future cash flows from the assumed perpetual life horizon of a company.

Beta

Beta is another important element in the CAPM. It measures systematic risk. It can be above, equal to or below one, representing the different degree of individual stock volatility in relation to the market portfolio. The traditional approach to estimating beta of an actively traded stock is by running ordinary least square regression of the total historical return of individual equity on the total historical return of the diversified and market-capitalization weighted index. The slope of the regression equals the raw beta. Alternatively, the regression beta estimation method can also be based on excess return.

In terms of the length of return period, Pratt (2002) states that a five-year period is the most common choice. Longer estimation periods would place too much weight on irrelevant data. Many institutional investors and market intelligencers such as Merill Lynch, Morningstar Ibbotson and Compustat also adopt this choice. Other alternatives such as a two-year measurement period has been chosen by Bloomberg to estimate beta. But, it is more appropriate for emerging markets rather than mature market like U.S. Jacobs and Shivdasani (2012) find that in AFP's survey, over 40% of respondents select five years and only about 13% choose two year data in their estimation of beta. Regarding the frequency of data, Morningstar Ibbotson adopts the monthly data. This choice has been widely accepted although Value Line uses weekly data in its beta estimation. Koller et al. (2010) argue that the use of more frequent return data such as weekly and daily can lead serious systematic error.

Industry-adjusted Company Beta: A range of new techniques have been developed to improve the raw beta generated directly from regression. The industry-adjusted company beta has been recommended by many studies and widely used in practice. It reflects the systematic risk more accurately since it is on the basis of industry or peer average rather than individual company to avoid bias. Usually, companies in the same industry tend to have similar operating or unlevered beta due to similar operating risk. The first step of the estimation of industry-adjusted company beta is to identify a series of comparable firms for the subject company. The second step estimates each company's raw beta by regression. Since the raw beta (levered beta) reflects the capital structure of a firm and also the leverage in its capital structure, the third step removes the effect of leverage for each firm to obtain the unlevered beta. This approach is especially appropriate for a firm with debt levels that significantly differ from its peer average or its own historical mean value (Pratt, 2002). Many studies suggest the formula (Equation 3) to estimate the unlevered beta. The fourth step determines the median value of unlevered beta for peers. The last step re-levers the median unlevered beta with the subject company's target capital structure or industry-average capital structure to obtain the industry-adjusted company beta.

$$\mathrm{B_u} = \frac{\mathrm{B_L}}{1 + (1 - t)\, D/E} \qquad (3)$$

Where: Bu is the unlevered beta; BL is the levered or raw beta; t is the average marginal/effective tax rate of the company during the beta measurement period; D is the average market value of company's debt during the beta measurement period and E is the average market value of company's equity during the beta measurement period

Beta Smoothing Method: The regression raw beta is estimated from historical data. Thus, a so-called "smoothing" adjustment is normally required to be consistent with the forward-looking concept of valuation. This process smooths any extreme estimated beta deviates from the average. Koller et al. (2010) indicates that smoothing is particularly necessary when there are few or even no direct comparable exist. The smoothing method introduced by Marshall Blume (1971) adjusts beta toward the mean value of one over the long run, to reflect the fact firms tend to close to market average risk levels when becoming mature. This method has been adapted by many market intelligencers such as Bloomberg and its expression is given in equation (4) below. Jorion (1986) presents a more advanced smoothing method to adjust raw beta (Equation 5). Rather than adjust the raw beta toward value of one to represent the average market risk, the shrunk beta recommended by Morningstar Ibbotson is more logical since it adjusts beta toward peer mean value.

$$\beta_{adj} = \left(\frac{1}{3}\right)(1) + \left(\frac{2}{3}\right)\beta_{unadj} \tag{4}$$

$$\beta_{adj} = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_b^2}(1) + \left(1 - \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_b^2}\right)\beta_{unadj} \tag{5}$$

Where: β_{unadj} = Unadjusted beta such as raw beta; σe = Time series standard error of subject company beta; σb= Cross sectional standard deviation of all peer betas

Sum Lagged Beta Technique: The market price of smaller stock tends to react to the movement of overall market with a lag, and the lag is negatively related to the size of company. Ibbotson et al. (1997) argue that the traditional beta estimation method such as regression is likely to underestimate the systematic risk of small firms due to the lag effect. Hence a substantial positive adjustment of beta is necessary. A so-called sum lagged beta technique suggested by the Morningstar Ibbotson is a common approach to adjust raw beta and deal with the return lag effect of small cap firms. It is also an effective solution to the thinly traded stock with underestimated beta. Koller et al. (2010) point out that in the sum lagged beta model, a stock's (excess) return is simultaneously regressed on concurrent market (excess) returns and market (excess) returns from the prior period, the two betas from the regression are summed and the monthly return period is the most common choice.

Equity Market Premium

The equity market premium is the expected excess return that overall stock market provides over a risk-free rate to compensate investors for taking on the relative higher risk. The equity market premium is a key component in the single factor model such as CAPM, and also an important element of the multi-factor model for example the Fama-French model. In the United States, the expected equity risk premium is countercyclical and tends to be high during bad times but low during good times (Pinto et al., 2009). Although equity market premium should be the same at any time for everyone, analysts do not reach this consensus. Jacobs and Shivdasani (2012) find that in AFP's survey, almost half respondents estimate the equity market premium at about 5%-6% during the current US economic recovery, about 23% respondents tend to be more optimistic and choose 3%-4%, only 11% use less than 3%. Hence, the estimation of an appropriate equity market premium is one of the most important tasks in the application of WACC or cost of equity. Until recent, there are a range of equity market premium estimation methods have been developed and the following sections illustrate them respectively.

Historical Approach: The historical approach is a common choice when the long-term reliable market returns are available, Koller et al. (2010) states that if the level of risk aversion hasn't changed over the past long period, the historical excess returns should be a reasonable proxy for future premiums. The equity market premium in the historical approach is calculated as the difference between the mean realized market index return and the mean government debt return during the selected sample period (see equation (6) below).

In terms of sample period selection, many studies suggest the longest available series of reliable return data. Koller et al. (2010) point out if the market risk premium is stable, a longer history significantly reduces estimation error. Pratt (2002) states that focus on a shorter historical date range would magnify the effect of the most recent unusual events, use a longer range of data places less emphasis on each event and better captures long term performance. The author also recommends an exponential weighting scheme which offers effective solution to the time length selection. This scheme assumes the future will produce a similar economic climate to the recent period, and then averages the historical data to allow more importance to be placed on current data.

On the other hand, the type of mean return selection (geometric or arithmetic) has been a subject of intensive argument. The general view of the difference between them is that arithmetic averages are better forward-looking point estimates, and geometric averages are better for historical analysis of a defined data range (Pratt, 2002). A number of studies indicate the arithmetic average is preferred since the major cost of capital estimation model such as CAPM is single period model. The arithmetic mean return is the average one-period return which best represents the mean return in a single period. Morningstar Ibbotson and Brealey et al. (2011) also support the view that if the equity market premium is estimated from historical returns, the long-term arithmetic average is the best proxy for today's equity market premium. However, Pinto et al. (2009) argue that the geometric mean is increasingly preferred for use in historical approaches, because the geometric mean is a compound rate and the absolute valuation models involve the discounting over multiple time periods. Hence, it is a logical choice for estimating a required return or equity market premium in a multi-period context. Besides, Koller et al. (2010) criticize the arithmetic average as very likely to bias the discount rate upward. The authors then present a method which is originally designed by Marshall Blume to solve the conflict of the geometric and arithmetic mean. This method argues the true market risk premium lies somewhere between the arithmetic and geometric averages. It determines the weights of both types of means according to the time length of future cash flows. Its expression is given in equation (7).

$$\begin{aligned}\text{Excess Return of Market Return over Risk Free Rat2} &= (1 + \text{Market Return})/(1 + \text{Risk Free Return}) - 1 \\ &\approx \text{Market Return} - \text{Risk Free Return}\end{aligned} \tag{6}$$

$$\mathrm{R} = \left(\frac{\mathrm{T} - \mathrm{N}}{\mathrm{T} - 1}\right)\mathrm{R_A} + \left(\frac{\mathrm{N} - 1}{\mathrm{T} - 1}\right)\mathrm{R_G} \tag{7}$$

Where: R = Equity market premium; T = Number of historical observations in the sample; N = Forecast period of the cash flow being discounted; R_A = Arithmetic average of the historical return and R_G = Geometric average of the historical return

However, the use of historical approaches to estimate the equity market premium has been subject to criticism over time. A number of drawbacks have been discovered. Non-stationarity and survivorship bias are two major issues. Pinto et al. (2009) indicate that the use of historical estimates to represent the equity market premium going forward is under the assumption that, the return series are constant over the past and into the future (stationarity). Besides, the amount of excess return that investors expect for their future time horizon is assumed to approximately equal to the excess returns that have actually been achieved (Pratt, 2002). However, the stationarity assumption may not hold since the non-stationarity of return time series is a common issue, especially for the emerging markets due to the unstable monetary policy such as sudden and large interest rate change. Thus, in case of an unstable time series of return, a five-year horizon has been recommended by many studies to maintain a reasonable level of stationarity. Besides, Fitzgerald et al. (2011) find evidence that survivorship bias tends to inflate the realized equity market premium, since the realized return does not include firms already failed. Thus, many studies suggest downward adjustment to the historical estimate of equity market premium. For example, Ibbotson and Chen (2001) recommend a 1.25 percentage point downward adjustment to the Morningstar Ibbotson historical mean U.S. equity market premium estimate. Copeland et al. (2000) recommend a downward adjustment of 1.5 percent to 2.0 percent for survivorship bias in the S&P 500 Index, using arithmetic mean historical estimates.

Forward-looking Approach: Due to the drawbacks of the historical approach, the forward-looking approach is a good alternative in the estimation of equity market premium. Since the equity market premium is based only on the expectations for economic and financial variables from the present going forward, it is logical to estimate the premium directly based on current information and expectations concerning such variables (Pinto et al., 2009). The rearranged Gordon growth model is one of the most widely used forward-looking approaches by investment bankers and fund managers to estimate the equity market premium. However, the premium estimated by the Gordon growth model may not be the same as the one produced by the historical approach. Fama and French (2002) find that prior to 1950, the historical and Gordon growth model estimates for the U.S. equity market premium agree, but from 1950 to 1999, the Gordon growth model estimate averages less than half the historical estimate. The authors attribute the difference to the effect of positive earnings surprises relative to expectations on realized returns.

In addition, the macroeconomic model is another type of forward-looking approach. Although less commonly used in practice, Pinto et al. (2009) indicate the macroeconomic model is more reliable when public equities represent a relatively large share of the economy. The model uses the relationships between macroeconomic variables and financial variables that figure in equity valuation model to estimate the equity market premium. Ibbotson and Chen (2003) present a macroeconomic model that estimate the equity market premium according to four variables, its expression is given below.

$$\begin{aligned}\text{Equity market premium} &= [(1+\text{EINFL})(1+\text{EGREPS})(1+\text{EGPE})-1]+\text{EINC}\\ &-\text{Expected risk free return}\end{aligned} \tag{8}$$

$$\text{EINEL} \approx \frac{1+\text{YTM of 20 year maturity T bonds}}{1+\text{YTM of 20 year maturity TIPS}}-1 \tag{9}$$

Where: EINFL is the expected inflation; EGREPS is the expected growth rate in real earnings per share (real GDP growth rate); EGPE is the expected growth rate in the P/E ratio (if efficient market, EGPE = 0) and EINC is the expected income component which equals to the sum of market index dividend yield and reinvestment return

Regression Approach: The regression approach estimates the equity market premium by using financial ratios such as the aggregate dividend to price ratio, the aggregate book to market ratio, or the aggregate ratio of earnings to price to estimate the expected excess return on market index (Koller et al., 2010). Until recently, there are a number of studies that prove the financial ratio especially the dividend yield is a good predictor of the long run return. The adjusted R-squared for the regression of future excess market return (equity market premium) on the current aggregate dividend yield is high. The regression coefficient is positive and statistically significant. Cochrane (2005) states the superior predictability of dividend yield is due to the time-varying risk premium. For example, today's high dividend yield is indicative of a low market index, since the overall stock market risk is perceived to be risky due to a forecast of tough economic condition ahead. Thus, future return needs to be higher as well. However, Koller et al. (2010) criticize the regression approach because it generates negative estimated equity market premiums. This is inconsistent with risk-averse investors who demand a premium for bearing higher systematic risk. The authors further argue that the regression approach ignores the fact that dividend yield depends on the earnings growth rate, and the dividend is just one form of the corporate payout. Due to the over-simplicity and drawbacks of regression approach, it is not as popular as the historical approach and forward-looking approach.

CONCLUDING COMMENTS

This study offers a comprehensive overview of the existing estimation methods for the discount rate used in listed company valuation practice, and then attempts to improve these methods respectively, the details are summarized below:

First, for the cost of equity estimation method, this study improves the traditional form of build-up model by replacing its size premium with the beta-adjusted size premium, so that the size premiums for firms in different size groups can be better estimated. This study also introduces an expanded capital asset pricing model. This model replaces the raw beta with the shrunk beta which adjusts the raw beta toward industry or peer mean value. The beta-adjusted average size premium and the firm-specific risk premium have also been added to capture the unsystematic risk that is not fully measured by the traditional form of capital asset pricing. This study further introduces a target price-based multistage Gordon growth model which chooses the consensus target price as a proxy of the intrinsic value to be consistent with the assumption of the basic Gordon growth model. Second, this study offers effective solution to the estimation of cost of debt for companies above and below investment grade. The marginal tax rate and the forecasted rate on new debt issuance are recommended when estimate cost of debt. Third, this study suggests the forward-looking target capital structure might combine the cost of equity and cost of debt. A three-step approach is proposed to identify the possible target structure that the companies are likely to adopt in the long term.

As a result of the above improved methods, a more accurate discount rate can be estimated, and more reliable company valuation results can be generated in practice. This study improves the discount rate estimation method from pure theoretical side. Future study could apply quantitative research approach to verify the effectiveness of the improved methods introduced by this study.

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