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Risk-adjusted hurdle rates for organizational units and types of investments

Estimating the systematic risk for divisions and
foreign investments of multidivision firms

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1 Introduction

Several studies have observed a significantly growing application of sophisticated capital budgeting techniques in practice. In some areas the theory-practice gap is constantly diminishing. Additionally, there is an ongoing tendency towards incorporating several risk assessment techniques within firms. It seems that a consensus is reached amongst researchers and practitioners about several capital budgeting techniques. This thesis deals with a topic that is still more controversy. The issue of estimating risk-adjusted cost of capital is addressed with respect to the different theoretical approaches that have become popular in theory and their application in practice is studied. Consequently, the topic of estimating hurdle rates for projects with different risk characteristics is a matter of interest. More specific, the topic of assessing the systematic risk of a set of projects which are grouped according to their risk characteristics is addressed. What kind of theoretical approaches are offered in theory and how or if they are accepted or widespread amongst managers in practice is questioned.

Since there is an ongoing tendency for firms to become more and more diversified and to operate on an international level the topic of risk-adjusted hurdle rates is compelling since the different investments likely have dissimilar risk characteristics. Consequently, a uniform evaluation of all investment projects within a firm might lead to incorrect investment decisions and to a misallocation of capital within the company (Block 2003). Specifically, this thesis discusses in detail the estimation of the systematic risk when calculating cost of capital for a division or for foreign projects. Since the focus is set on the estimation of the systematic risk, the other components of the cost of capital are discussed briefly but not in further detail.

The topic of risk-adjusted hurdle rates is addressed with reference to the usage in practice. Thus, the theory and practice gap of incorporating risk-adjusted hurdle rates in companies with a detailed discussion on the methods actually used by managers in practice is studied. The basis for this thesis is a paper of Block (2003) which gives insights on the usage rates of divisional cost of capital and on the several approaches on which firms rely on when deriving hurdle rates. Since there is a vast amount of different approaches which are constantly revised, the thesis restricts itself to the main methods used in practice and their basic ideas. The pure-play approach, as well as the accounting beta method, which serve as a basis for further approaches are discussed in detail. Further adapted approaches, like the mathematical approach or the full-

information approach are not considered in detail since their application in practice is limited. The subjective method which plays an important or the most important role in practice is also a matter of interest.

The thesis is structured in the following. Initially, the reader is introduced to the topic of cost of capital and the consideration of risk in this context which leads to the importance of the risk-adjusted cost of capital. The estimation of cost of capital in general is discussed giving most attention to the systematic risk component. Afterwards the theories to estimate divisional or risk-adjusted hurdle rates that play a role in practice according to Block (2003) are discussed. The next part examines the acceptance and usage of divisional or risk-adjusted cost of capital over the years as well as the distribution of the various methods in practice. Furthermore, the issue of how projects are categorized within a company is addressed. In the next chapter some papers that introduce firm-specific examples are presented. As a final part the topic of foreign investments is treated. The different theoretical approaches underlying the estimation as well as studies giving empirical evidence are discussed. Finally, practical implementation issues which are similar to the estimation approaches of divisional cost of capital are presented and additionally illustrated with a firm-specific example.

2 Insights into the cost of capital concept

The cost of capital is used as a decision criterion for the allocation of capital in the budgeting process. Fundamentally, it is defined as the required rate of return that is needed to justify the investment and therefore gives a good reason for the use of capital. Thus, the calculation of an appropriate cost of capital or required rate of return is an important part of the investment decision. (Pinches, 1991:393), (Van Horne 1986:90)

The cost of capital can be considered as an investor's opportunity cost of investing in a particular firm that is used as a cut-off criterion for investment decisions. Sometimes the cost of capital is referred to as hurdle rate because maximizing shareholder value means investing in projects that earn more than the cost of capital. Consequently, if a firm is not able to earn in excess of its cost of capital it will not create value for its investors. In general, shareholders demand higher returns for riskier projects. That is why a company that is investing in risky projects will have higher cost of capital or required rate of return than a company investing in less risky projects. (Brigham 2003:358pp) (Pagano 2004:13)

According to Pinches (1991:244), three approaches to specify the required rate of return can be distinguished. With the first approach, a single firm-wide required rate of return based on the firm's Weighted Average Cost of Capital is calculated and used as a common decision criterion for all investments within the company. Using this single rate is appropriate when the firm is investing only in homogenous projects considering risk. The second approach bases the investment decision on the divisional cost of capital. Considering a multidivisional firm, the individual divisions may establish different required rates of return due to the different risk level of each division. The third one suggests a project-specific discount rate based on the risk of every individual project which is often estimated using the Capital Asset Pricing Model, CAPM. This thesis specializes on the second approach and tries to identify the importance and advantages of the divisional method. At this point it is important to mention that the term "divisional" or "division" has to be considered in a broader context. That means that this term refers to divisions as well as product lines, segments, subunits or any meaningful grouping of projects that belong to a category in which investments have similar risk characteristics. It refers also to the grouping of different types of investments. A special case in this context, namely the treatment of foreign investments will be discussed in detail in chapter 7.

In the literature, a widely recommended measure to calculate the cost of capital is the Weighted Average Cost of Capital, briefly WACC, which is commonly determined as the cost of the mix of debt, preferred stock and common equity of a firm (Brigham 2003:371), (Pinches 1991:369).

According to a study by Block (2003:345) approximately 85 percent of major U.S. firms use the concept of the Weighted Average Cost of Capital to calculate their cost of capital. More than 50% use this single hurdle rate to evaluate all investment projects. Consequently, a lot of firms seem to use a single WACC as a cut-off criterion in capital budgeting and evaluate all projects according to this particular rate.

In the case of a multidivisional firm the use of this single firm-wide cost of capital ratio can lead to incorrect investment decision. Since the risk of a project can heavily differ from the firm risk, it can be mistaken to use the company cost of capital to evaluate the project. Brealey and Myers (1992:209) put it clearly by stating that “company costs of capital are nearly useless for a diversified firm”.

2.1 The consideration of project risk

Since riskier projects should be evaluated with a cost of capital that is able to mirror the risk of the project the challenge is to estimate the project risk in order to be able to distinguish a risk-adjusted discount rate.

According to Brigham (2003:378) three different types of risk can be defined. Stand-alone risk is the project's risk disregarding all other projects of the company and the effect of diversification. The project is evaluated in isolation and is measured by the variability of the projects expected returns. The corporate or within-firm risk disregards the effects of stockholder's diversification. That means that the firm is considered in isolation and the risk is measured by the project's influence on the uncertainty about the company's future earnings. Finally, the market or beta risk represents the project's risk from the viewpoint of a well-diversified stockholder who considers the project as only one of the company's projects. Consequently, it is the type of risk that cannot be eliminated by diversification and therefore it is the only risk that has to be considered by a well-diversified shareholder. The beta risk or so-called systematic risk, which is the covariance between some measure of return on the project and the return on the market, is represented by the beta coefficient of the project. Theoretically, the systematic risk is considered as the most important risk but it is also most difficult to estimate. That is why decision makers often develop subjective risk categories based

on judgment. The estimation of the project beta or rather the divisional beta will be the main task in calculating divisional cost of capital and will be discussed in detail in chapter 4.

2.2 Problem of using a single company cost of capital

The problem of using a single firm-wide cost of capital ratio is the difference in the level of project risk throughout all projects and divisions within a multidivisional firm. In cases where projects reveal significantly different risk levels compared to the average company risk which is reflected in the company cost of capital the use of a single firm-wide ratio leads to a misallocation of resources, because the firm-wide cost of capital does not allow for imbalances considering the risk of projects.

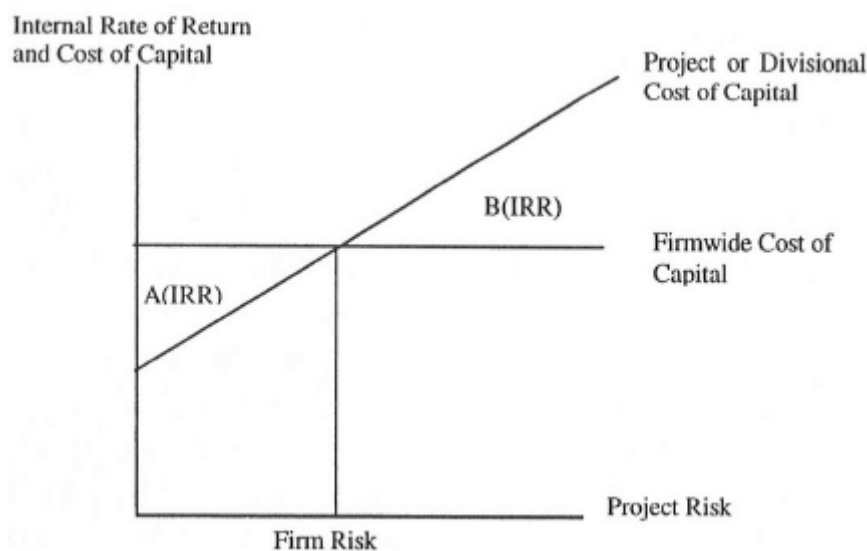


Figure 1: The Effect of the Use of Firm-wide and Divisional Cost of Capital (Block 2003:346)

A result of ignoring these imbalances is the failure to maximize shareholder wealth, because using a firm-wide cost of capital ratio leads to poor investment decisions and is resulting in a misallocation of capital within the firm. Specifically, on the one hand projects that are planned by high risk-divisions are preferred because of their potentially higher returns. On the other hand projects of low risk divisions will not be accepted because their relatively low returns are not able to reach the firm-wide cost of capital. (Block 2003:345), (Brigham 2003:377), (Pinches 1991:244), (Fuller 1981:997)

Figure 1 demonstrates this effect. The internal rate of return, IRR of Project B is significantly higher than that of Project A, but Project B is also much riskier than Project A. If the single firm-wide cost of capital is the cut-off criterion, Project B will be accepted, because its IRR lies clearly above the firm-wide cost of capital. On the other hand Project A will be rejected, because its IRR is not able to reach the firm-wide cost of capital. If a risk-adjusted project or divisional cost of capital is used, the decision will be reversed. Project A, on a risk-adjusted basis looks quite profitable whereas the high-risk Project B fails to reach the divisional cost of capital. The consequence of using a firm-wide cost of capital ratio is a reduction in the firm value caused by a misallocation of capital, because stable projects will always starve for capital. (Block 2003:345), (Pinches 1991:388), (Fuller 1981:997)

2.3 Basic concept of divisional cost of capital

The estimation of an appropriate cost of capital ratio is not an easy challenge, since no method when dealing with risk is absolutely precise. Pinches (1991:246) refers to this process as “part science and part judgment”. Nevertheless, it seems unavoidable in the process of maximizing firm value.

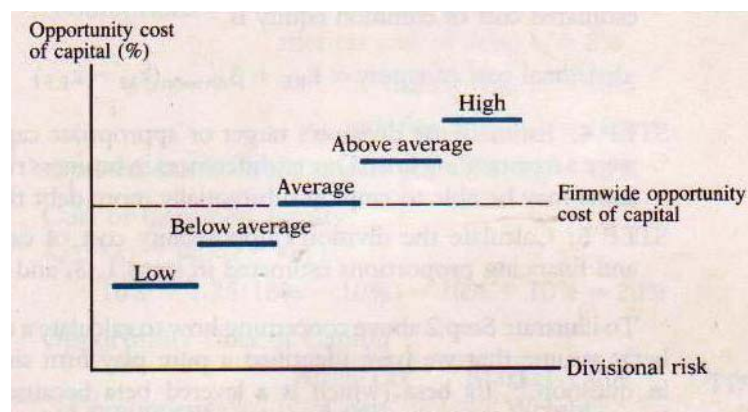


Figure 2: Divisional cost of capital (Pinches 1991:389)

While the calculation of the cost of capital on a project by project basis is theoretically recommended it is difficult to use in practice. Calculating the cost of capital for every project is cost and time demanding. Since every firm has to face a trade-off between cost and benefit, project based cost of capital might not be justifiable. Furthermore, the necessary data for estimating the systematic risk of a project might not be available. An

alternative to the individual cost of capital are the use of a divisional cost of capital, since divisional risk is normally a better proxy for project risk than overall firm risk. Figure 2 shows how different cost of capital rates are employed depending on the riskiness of the division.

The concept of divisional cost of capital is based on the assumption that all projects within a division are homogeneous but different between several divisions regarding their systematic risk. Consequently, all projects of a single division are evaluated with the divisional cost of capital. This can be seen as a compromise between project and company cost of capital. (Brealey 1992:209), (Fuller 1981:998), (Gordon 1974:1161), (Pinches 1991:389)

The evaluation of the firm as a whole might result in disregarding important information. The individual treatment of business units “is at the heart of value-based management” (Copeland 2000:301).

As already pointed out the term “divisional” is considered in a broader context meaning that the several approaches can be used for any kind of grouped category. The criteria for classifying investments refer to the organizational level like all projects accomplished in a specific subunit or all projects that belong to the same product line of a firm. It also refers to the type an investment belongs to like all projects undertaken in a foreign country or all replacement projects.

In chapter 4 various methods developed to estimate the cost of capital for a division are introduced. Initially, in the next chapter the cost of capital estimation in general is presented since all concepts are based on these theories. Specifically, the theories of the Weighted Average Cost of Capital and the Capital Asset Pricing Model in the context of the cost of capital estimation is discussed in the following.

3 Estimating the cost of capital

The methods to estimate divisional hurdle rates, described in the following chapters, are based on the financial concepts of Weighted Average Cost of Capital and the Capital Asset Pricing Model. The basic ideas of these concepts will be summarized in the following section. A focus is set on the estimation of the systematic risk beta since especially the objective methods, discussed in chapter 4, are founded on the assessment of beta.

3.1 The Weighted Average Cost of Capital

Many studies show that the Weighted Average Cost of Capital concept has found a wide application in practice. (Block 2003:345), (Bruner 1998:14), (Gitman 1982:23)

The general formula is:

$$WACC = k_b(1 - T_c) \frac{B}{V} + k_p \frac{P}{V} + k_s \frac{S}{V} \quad \text{with} \quad (1)$$

k_b = the pre-tax market expected yield to maturity on noncallable, nonconvertible debt

T_c = the marginal corporate income tax rate,

B = the market value of interest-bearing debt

V = the market value of the enterprise

k_p = the after-tax cost of capital for noncallable, nonconvertible preferred stock

P = the market value of the preferred stock

k_s = the market-determined opportunity cost of equity capital

S = the market value of equity.

Before the estimation of the several components of the WACC will be discussed, a short introduction is given about the factors that have an influence on the WACC and how the firm is able to control them.

There are different factors that influence the Weighted Average Cost of Capital. A distinction between factors that the firm in general cannot control and factors that can be influenced or decided on by the firm can be made.

The factors that cannot be directly controlled by the firm are:

- The level of interest rate
- The market risk premium

- The tax rate

Even if the calculation involves some managerial judgment and is sometimes a matter of choice, these factors can be regarded as beyond a company's direct control, but have an impact on its cost of capital.

The other factors involve management decisions, thus they can be determined by the company directly. The following factors can be controlled:

- The capital structure
- The dividend policy
- The investment policy

The last factor leads to the importance of risk-adjusted cost of capital. When the cost of capital is estimated it reflects the risk of the company's existing assets and new capital is assumed to be invested in assets with the same risk. If investment policy heavily changes the cost of capital should reflect this change. For example if a division is investing in an entirely different business line the cost of capital should reflect the risk of that specific division and not the risk of the overall company. The other factor that has a vast impact on the cost of capital is the capital structure. (Brigham 2008:360p.)

Since it is also a very important issue in the estimation of divisional cost of capital it will be discussed in detail after having precisely discussed the calculation of the several components.

Even if the formula looks pretty simple the estimation of the components is "both art and science" and the analyst must sometimes rely on decisions based on his or her best judgment (Pagano 2004:16).

In general, the weights used in the WACC should always be target weights instead of current weights and it is important to use market values, because the firm should be considered as an ongoing concern and its cost of capital should reflect the weighted average of the different types of capital the firm uses disregarding the financing used to carry out a specific project. (Copeland, 2000: 202) (Brigham 2008:358p.) Consequently, the market value weights for the capital structure as well as the opportunity cost of non-equity and equity financing of the firm have to be estimated. This thesis specializes on the estimation of the equity capital and especially on the estimation of the beta or systematic risk but for the sake of completeness the other components of the formula will be described briefly. The previously stated formula considers three types of capital. Generally, each source of capital that involves cash payments now or in the future should be included. The formula can be expanded taking other sources of financing into consideration as well. The idea of the WACC is that a

project is accepted if it is profitable enough to pay the interest on the debt used to finance it and in addition reaches a higher expected rate of return on the equity invested in it. Consequently, it is the minimum rate the company has to earn to prevent a decrease in the value of the firm. (Brigham 2003:360)

3.1.1 Estimation of cost of debt and preferred stock

The first component cost to be estimated is the cost of debt. The firm's borrowing rate or cost of debt is defined as the following:

The after-tax cost of debt, which is reflecting the benefits of the tax deductibility of interest, is:

$$k_i = k_b(1 - T) \text{ with} \quad (2)$$

k_b = the before-tax cost of debt and

T = the firm's marginal corporate tax rate. Generally, the before-tax cost for long-term debt is established by solving the expected yield to maturity.

$$\text{Price} = B_0 = \sum_{t=1}^n \frac{I}{(1 + k_b)^t} + \frac{M}{(1 + k_b)^n} = I(PVA_{k_b, n}) + M(PV_{k_b, n}) \text{ with} \quad (3)$$

B_0 = current market price of the bond

I = the dollar amount of interest expected to be received each year

n = the number of years to maturity value of the bond

M = the par or maturity value of the bond. (Pinches 1991:100) (Pinches 1991:370), (Brigham 2003:360)

If a bond rating is not available, the average yield to maturity on a portfolio of long term bonds with the same credit rating can be used. The bond rating of rating agencies like Moody's or Standard & Poor's can also be used as a proxy for risk of debt. (Copeland 2000:210)

The cost of preferred stock in the WACC is calculated by dividing the preferred dividend by the current price of the preferred stock.

$$\text{Cost of preferred stock} = k_p = \frac{D_p}{P_p} \quad (4)$$

The formula holds if the preferred stock is not callable or convertible. In any other case the estimation is more complicated. In general the riskiness and consequently the cost of capital of preferred stock will be between the safer debt and the riskier equity. (Copeland 2000: 208), (Brigham 2003:362)

The last step in calculating the WACC is the estimation of the opportunity cost of equity financing. It is considered to be the hardest task because it is not possible to observe it directly and various assumptions and choices in practice have to be made. The cost of common equity can be defined as the rate of return investors require on the firm's common stock. A firm can raise new equity by retaining some of the current year's earnings or by issuing new common stock. The costs associated with retained earnings are not direct costs but opportunity costs. Shareholders have to be compensated for using their capital and if earnings are retained the company has to bring in at least as much as an alternative investment of comparable risk would earn. (Brigham 2003:362pp.)

There are several approaches to estimate the cost of common equity. This work concentrates on the Capital Asset Pricing Model. There are a lot of critics associated with the CAPM but since there is a lack of theoretical justifications of other theories the CAPM stays a widely accepted approach. Also in practice the CAPM is the predominant model used to estimate the cost of equity (Bruner 1998:15), (Pagano 2004:15).

3.1.2 Estimation of cost of equity using the CAPM

The model is used to analyze the connection between risk and return and is based on the concepts of risk reduction through diversification and risk premiums associated with risky investments. Since the Capital Asset Pricing Model is based on a quite complex theory and there is no room for a detailed discussion, the reader should be familiar with the general principles that underlie the model.

According to the CAPM the opportunity cost of capital is equal to the return on risk-free securities plus the market risk premium multiplied by the company's systematic risk represented by beta. The equation that is called the security market line, shown in figure 3, is:

$$k_s = r_f + [E_{(rm)} - r_f] \cdot \beta \text{ with} \quad (5)$$

r_f = the risk-free rate of return

$E_{(rm)}$ = the expected rate of return on the overall market portfolio

$E_{(rm)} - r_f$ = the market risk premium

β = the systematic risk of the equity.

Consequently, the cost of equity is related linearly to the undiversifiable risk, beta, which is the covariance-variance ratio between stock i and the market:

$$\beta_i = \frac{Cov_{im}}{\sigma_m^2} \text{ with } Cov_{im} = \rho_{im} \sigma_i \sigma_m \text{ and} \quad (5a)$$

σ_i = the standard deviation of the return of stock i

σ_m = the standard deviation of the market return

ρ_{im} = the correlation between the return of stock i and the market.

Thus, the calculation of the equity capital requires the estimation of the risk-free rate, the market premium and the systematic risk, beta. (Brigham 2008: 219), (Copeland 2000:214) (Pagano 2004:14)

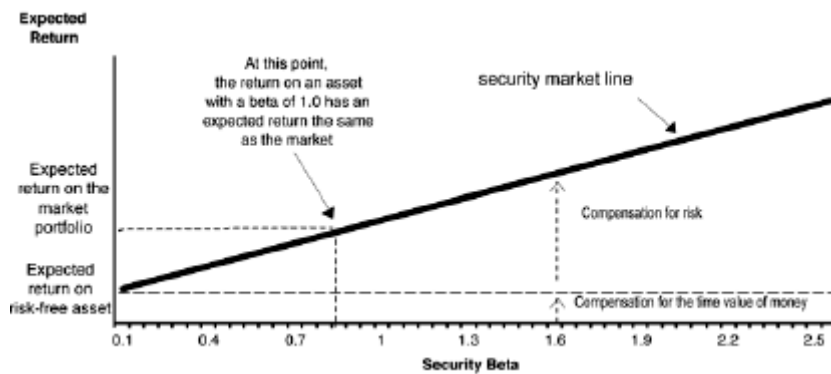


Figure 3: The security market line in the CAPM (Fabozzi 2003:296)

3.1.2.1 Estimating the risk-free rate and the risk premium

The estimation of the risk-free rate and the market premium also requires the manager's judgment. Even if textbooks, practitioners and advisers seem to agree on the CAPM, there is no existing consensus about estimating the components involved in the model. For estimating the risk-free rate there is a strong preference among practitioners to use a 10-year Treasury-bond rate which is also recommended in textbooks, because it matches roughly the time horizon of long-term investments and thus resembles the type of investment made by companies. (Copeland 2000:216), (Pagano 2004:16), (Bruner 1998:16pp.)

To estimate the market risk premium which is the difference between the expected rate of return on the market portfolio, which is represented by the return on a large equity portfolio, and the risk-free rate either historical data or ex-ante estimates can be

used. This topic causes a lot of controversy since it incorporates a lot of assumptions and choices to make. Fundamentally, the risk premium induces a risk-averse investor to invest in risky equities, thus it is driven primarily by the investor's attitude towards risk. In the survey of Bruner and his colleagues (1998:20pp.) all respondents agreed on historical data to estimate future returns, but they differed in the way they calculated the historical average. More specifically; they used different time horizons, an arithmetical or geometrical average of equity returns and realized returns on T-bills or T-bonds to proxy for the riskless assets. Because of the vast amount of choices to take and because the various estimation approaches lead to very different results, there is an ongoing discussion about the appropriate risk premium to use in practice. Generally, the recommended risk-premiums vary between 3.5% and 6.5%. (Brigham 2008:350), (Copeland 2000:223) (Pagano 2004:16)

3.1.2.2 The beta estimation

For the estimation of beta the theory calls for a beta that reflects the investor's uncertainty about future cash flows to equity. Since the future is not observable; proxies have to be used. Companies like Bloomberg, BARRA, Value Line, Standard & Poor's publish betas calculated from historical data for listed firms. Usually the beta is derived as the slope coefficient of the market model of returns. The formula is:

$$R_{it} = \alpha_i + \beta_i(R_{mt}) \text{ with} \quad (6)$$

R_{it} , return on stock i in time period $t = [D_{it} + P_{it} - P_{i,t-1}] / P_{i,t-1}$ with

D_{it} = dividend per share and

P_{it} = price per share;

R_{mt} = return on the market portfolio in period t ,

α_i = regression constant for stock i

β_i = beta for stock i .

Using historical data for returns on the stock and a market portfolio proxy, the beta can be estimated from a regression. Brigham (2008) demonstrates in his textbook the example of the beta estimation for the company General Electrics, shown in figure 4. The beta can be found by observing the relationship of the stock's historical returns relative to the historical market portfolio return and measures the sensitivity of the stock to market changes. Consequently, the beta coefficient is an indicator of the degree of

movement of the stock's return in comparison to the market portfolio return. Specifically if the market's return increases by 1% the return of a stock with a beta of 2.0 is expected to increase by 2%. To measure the market portfolio return a stock index like the Standard's & Poor's Stock Composite Index is commonly used. But the choice of the market index is, like the choice of the appropriate time period, a compromise to make. (Brigham 2008:255), (Bruner 1998:19), (Gitman 1988:228), (Copeland 2000:223)

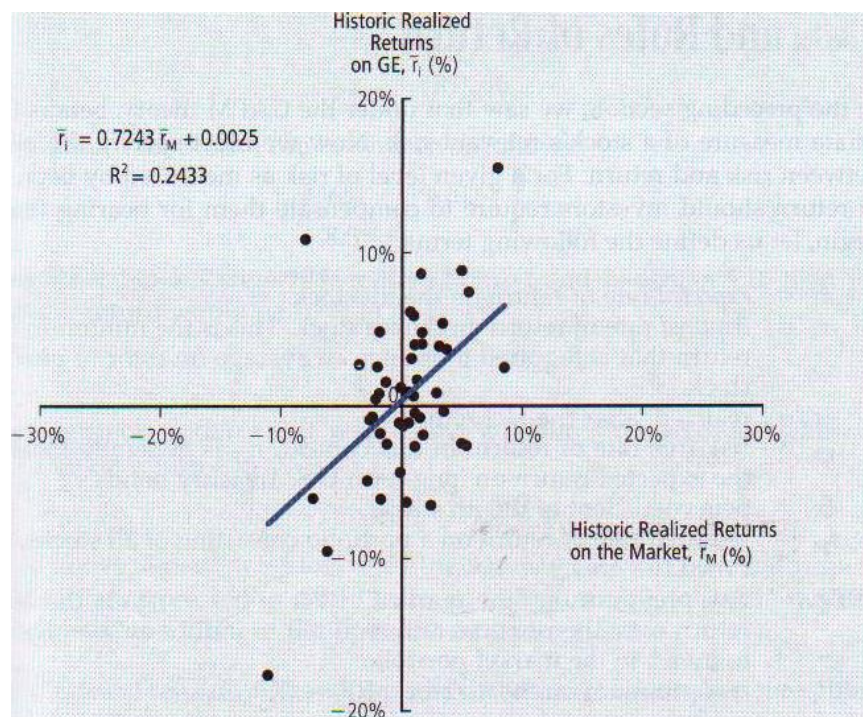


Figure 4: The beta estimation for General Electrics (Brigham 2008:225)

Sharpe and Cooper (1972:48pp.) have shown in their study that this relationship is relatively constant over time and that is why beta is considered to be “reasonably stable” especially for portfolios but also for individual securities. Consequently, past volatility is considered to be an appropriate proxy for future volatility.

The betas estimated by running the previously discussed linear regression are called historical betas since they are based on historical data. Because actually future betas are needed some adjustments have been developed to fulfill a future-oriented perspective. There are so-called adjusted betas and fundamental betas. Adjusted betas are based on the assumption that true betas tend to shift towards a value of 1.0, reaching exactly the same risk as the market, over time. This regression tendency towards the grand mean of all betas, 1.0, was especially researched by Blume (1975)

in several studies. The historical beta is adjusted by the expected future movement in order to be a better approximation of the future beta. The companies Value Line and Bloomberg, for example use approximately the following formula to calculate the adjusted beta:

$$\text{Adjusted}\beta = 0.67(\text{historical}\beta) + 0.35(1.0).$$

The so-called fundamental beta is constantly adjusted for fundamental changes in a company's operations and capital structure. The basis is again the historical beta which is modified. The consulting firm BARRA is known for providing fundamental betas. The choice of the appropriate beta is a matter of judgment and data availability. (Brigham 2008:260p.), (Bruner 1998:20p.)

In the study of Bruner and his colleagues (1998:20) more than half of the companies that responded to the survey relied on published sources for their beta estimates. Even using a published source involves a choice, because the several providers show different results for their beta estimates. Bruner and his colleagues (1998) give an example of the varying beta estimates throughout prominent providers. Figure 5 shows that according to Bloomberg the mean beta for the company is 1.03 in comparison to 1.24 published by Value Line.

	Bloomberg^a	Value Line	Standard & Poor's
Number	102	260	60
Time Interval	wkly (2 yrs.)	wkly (5 yrs.)	mtlly(5 yrs.)
Market Index	S&P 500	NYSE composite	S&P 500
Proxy			
Mean Beta	1.03	1.24	1.18
Median Beta	1.00	1.20	1.21

Figure 5: Beta estimates of prominent providers (Bruner 1998:20)

That is why Copeland (2000:223p.) suggests considering various sources and compare the estimates also to the industry average beta. Consequently, if the estimates from the different providers fluctuate significantly it might be better to use the industry average, because it is typically more stable. To use an industry average is also recommended for unlisted companies or divisions but this will be discussed in the next chapter. Similarly, it is suggested by Kaplan and Peterson (1998) to use a portfolio of firms operating in the same line of business as the company because estimates for individual firms do likely contain statistical noise (Kaplan/Peterson 1998:85).

Having specified all the components of the formula the weighted average cost of capital for the company can be easily calculated.

Since the variables in the formula refer to the firm as a whole it is appropriate for the “average” project. The WACC can also be calculated on a divisional basis for several business units, a product line or any segment. This will be discussed in the next chapter. The steps in calculating the WACC will be more or less the same regarding a company or a division but the determination of the target costs and capital structure on the divisional level might be more complex, because a strict separation of divisions might be a hard challenge and other than that market data is not available on a divisional basis. But on the other hand a separate valuation of business units seems to be unavoidable in value-based management. That is why the firm-wide WACC is often used as a company-wide benchmark for discount rates which is adjusted for unusually risky or unusually safe investments. (Brealey 1992: 497), (Bruner 1998:14), (Copeland, 2000: 202), (Pinches 1991:368)

Finally, before the discussion of the divisional cost of capital is started, the influence of the capital structure on the cost of capital is discussed in more detail as promised in the beginning, because it will be an important issue in the estimation of divisional cost of capital.

3.2 The capital structure and the cost of capital

Considering the WACC formula it is obvious that the capital structure has an impact on the cost of capital, since its several components have different costs. In general the WACC includes relatively low-cost debt and high cost equity capital. The important thing is that a change in one component affects all variables in the formula. For example, debt reduces the taxes a company pays but debt increases also the cost of stock. The cost of stock increases because the claim of stockholders becomes less certain since debtholders always come first in line. Thus, shareholders want to be compensated for the additional risk with a higher rate of return. Additionally, with an increase in debt the risk of bankruptcy increases leading to an increase in the pre-tax cost of debt (Brigham 2008:566).

The modern capital structure theory was introduced by Modigliani and Miller (1958). All further research is based on their work. The theorem holds that in a perfect market without tax the capital structure has no impact on the cost of capital or the value of the firm. Under the Modigliani Miller theory, in a perfect market with taxes the marginal weighted cost of capital is declining for firms that are highly leveraged. In a real world with market imperfections and taxes the optimal capital structure is found considering

the trade-off between tax benefits and the costs of high leverage, like for example bankruptcy costs. (Brigham 2008:576pp.), (Weston 1986:579pp.)

The effects of a firm's capital structure on the systematic risk, beta was specially studied by Hamada (1972) who developed the Hamada equation that illustrates the effects of financial leverage on beta. Since this formula plays an important role in the estimation of divisional cost of capital or rather in estimating a divisional beta it is discussed in detail. As stated before the use of debt has an effect on the risk of the firm's equity. Specifically, if a company has no debt, the market risk of its equity equals the market risk of its assets, thus $\beta_{equity} = \beta_{asset}$. But if the company uses debt financing, the market risk of its equity increases, thus $\beta_{equity} \geq \beta_{asset}$, because of the difference in the nature of claims of creditors and owners since the risk is not split equally among them. The greater the use of debt, the greater its equity market risk. Considering the interest deductibility of debt, the risk of the asset is the following:

$$\beta_{asset} = \beta_{debt} \left(\frac{(1-T)debt}{(1-T)debt + equity} \right) + \beta_{equity} \left(\frac{equity}{(1-T)debt + equity} \right) \quad (7)$$

with T representing the marginal tax rate. Additionally it is assumed that the company's debt does not have any market risk, $\beta_{debt}=0$.

$$\beta_{asset} = \beta_{equity} \left[\frac{1}{1 + \frac{(1-T)debt}{equity}} \right] \quad (8)$$

Consequently, an asset's beta is connected with its equity beta that is adjusted for financial leverage. The other way round a firm's equity beta can be defined using its asset beta. (Fabozzi 2003:466p.)

The process of unlevering and relevering beta is used to be able to utilize a published beta of any traded firm that probably has a different capital structure, as a proxy for the beta of a division. This will be discussed in detail in the next chapter.

The following approaches of estimating divisional cost of capital are all based on the theories that were discussed in this chapter. The described theories are necessary to calculate and interpret the various methods of divisional cost of capital. In the following several chosen approaches that have been developed to estimate divisional cost of capital are presented. The methods have been selected according to their importance in practice meaning that a focus is set on the methods that according to Block (2003) are actually used among firms.

4 Estimating divisional cost of capital

Risk is the primary determinant of the divisional cost of capital concept. The discount rate used to evaluate different investments should be adjusted for the riskiness of the underlying projects. A good measure of risk in a well-diversified portfolio is beta, because “the majority of the variation in return is attributable to changes in the return on the market” (Sharpe/Cooper 1972:48).

Since divisions do not trade in the market it is not possible to compare the stock’s return and the return of the market and measure its market risk. Consequently, the estimation of divisional betas is more complex and controversial.

In this chapter the methods that estimate the systematic risk for single divisions using a developed proxy beta to approximate the unobservable divisional beta are discussed. Fundamentally, two main approaches exist in the literature that serve as a basis for the estimation of divisional betas. These methods have been extended and modified throughout the years and there is still an ongoing discussion in finding the appropriate measure.

At first these two objective approaches that estimate the systematic risk of a division will be introduced and afterwards compared to a subjective measurement that is based on management’s judgment of perceived risk.

According to the study of Block (2003:353) the discussed methods, especially the subjective method are also used most of all in practice. The application and acceptance in practice will be described in detail in chapter 5.

4.1 Objective methods

The first alternative to specify the divisional beta is an analogous firm approach while the other approach is an accounting based method. Since the beta of a division is unobservable in the market, because single divisions do not trade, another way to estimate divisional cost of capital must be found. The two approaches differ in the estimation of the divisional beta or rather estimation of a proxy beta in the way that they use different sources of data. The first method uses market data to develop the proxy while the second one, as the name predicts, is based on accounting data. Both methods afterwards incorporate the derived proxy beta in the capital asset pricing model to calculate the divisional cost of capital. (Fuller 1981:997p.), (Bower 1975:46pp)

4.1.1 Pure - play approach

The analogous firm approach or analogy approach is in the literature referred to as the pure-play approach. This method was especially popularized by Fuller and Kerr (1981) who have empirically tested it.

In the pure-play approach the manager or analyst tries to identify several single-product companies that are acting in the same line of business as the project or the division being evaluated. Consequently a pure-play firm is a publicly traded firm in solely the same line of business with the same operating risk as the division of the firm. It is important that the firm is operating in only this single line of business.

In his textbook Fabozzi (2003) demonstrates an example from a Value Line Investment Survey in 2002 of several identified pure-play firms, shown in figure 6.

Company	Line of Business	Equity Beta	Debt-to-Equity Ratio	Asset Beta
7-Eleven	Convenience stores	0.75	2.00	0.034
Gap	Retail apparel	1.55	0.18	1.40
Mattel	Toy manufacturer	0.75	0.13	0.69
McDonald's	Fast-food restaurants	0.85	0.30	0.70
Office Depot	Retail office supplier	1.25	0.10	1.18
Universal Corporation	Tobacco	0.60	0.47	0.46

Figure 6: Equity and asset betas for selected firms with a single line of business (Fabozzi 2003:469)

If more than one could be found the average of the identified pure-play betas is used as a proxy for the beta of the division in question. Thus the important part is finding appropriate pure-play firms to be able to use their betas as proxies. Then the pure-play technique is used in association with the CAPM to calculate the divisional cost of capital. (Brigham 2008: 363), (Pinches 1991: 389), (Fuller 1981: 997)

Consequently, as already mentioned in chapter 3.1.2.2, a pure-play proxy beta can be identified using the beta of a single company in the same line of business, or the average beta of a portfolio of firms operating in the same line of business, or the industry average. Copeland (2000:308) suggests that a group of managers should select a proxy beta of the industry with risk closest to the firm in question from a prepared listing of industry betas.

The next paragraph will describe the pure-play method according to Pinches (1991: 389) and Brigham (2008:363).

The first steps in establishing divisional cost of capital according to the pure-play approach is estimating the company's after-tax cost of debt and use it as the cost of debt for the single divisions. According to Pinches (1991:389) using separate after tax-cost for each division reveals approximately the same result. The next step is to identify one or more pure-play firms and use the average beta as a proxy. How the beta of a publicly traded firm is found was discussed in chapter 3.1.2.2. If the pure-play firm has a different capital structure than the division, an adjustment will be required since the capital structure influences beta. To overcome this bias the unlevered beta of the pure-play firm is calculated according to Hamada as discussed in chapter 3.2. This approach of unlevering the pure-play beta and then relevering the unlevered beta according to the capital structure of the multidivisional company has been questioned by Fuller and Kerr (1981:1002pp.) who have found in their empirical study better results for using the unadjusted pure-play beta as approximation of the multidivision firm's beta. This research study will be discussed in detail later on.

The unlevered beta is calculated corresponding to the Hamada-formula as the following:

$$\beta_{unlevered} = \frac{\beta_{levered}}{1 + (1 - T)(B / S)} \text{ with} \quad (9)$$

T = the pure play firm's effective marginal tax rate

B = market value of pure play firm's debt

S = market value of pure play firm's equity.

The unlevered beta is then used to calculate the divisional beta by substituting the marginal tax rate and the capital structure proportions of the division in the equation and solving for the levered beta.

The next step involves calculating each division's cost of equity by using the previously established divisional beta. The divisional cost of equity capital is:

$$k_{RF} + \beta_{division} (k_M - k_{RF}) \text{ with} \quad (10)$$

k_{RF} = risk free rate,

k_M = the expected return on market portfolio and

$\beta_{division}$ = the market risk of the division.

Afterwards the appropriate capital structure is estimated as if the division were a freestanding firm. Finally the weighted average of the divisional cost of capital, as discussed in chapter 3.1, on the basis of the previously established cost and financing proportions can be calculated.

A potential problem of this approach is the difficulty to find pure-play firms that are publicly traded for every single division of a firm. This issue and other critics of the method will be discussed later on. At first a review of Fuller and Kerr's (1981) empirical study of the pure-play approach is given.

4.1.1.1 Empirical evidence of the pure-play method

Fuller and Kerr (1981) were the first that have empirically tested the pure-play technique with market data. In their study they used several multidivision firms and identified pure-plays for every division. The weighted average of the pure-play betas approximately equaled the observed beta of the multidivision firm. Thus, the pure-play method seems to be an acceptable procedure for estimating divisional betas.

The value additivity principle provides the theoretical foundation. Under the assumption of a perfectly competitive market with full information and no transaction costs it follows that the value of the multidivision firm equals the sum of the market values of its divisions.

$$V_j = \sum_i V_{ij} \text{ with} \quad (11)$$

V_j = the market value of the multidivision firm

V_{ij} = the market value of the i^{th} division of the j^{th} multidivision firm.

Fuller and Kerr use the CAPM to specify the cost of equity capital which is a linear function of its systematic risk, described in chapter 3.1.2 with formula (5). Thus, beta is a measure of the systematic risk of the multidivision company which is the only "firm characteristic" necessary to determine the cost of equity capital. (Fuller 1981:999) Accordingly, the beta for the whole multidivision firm approximately equals a weighted average of the sum of the divisional betas of the firm.

$$\beta_j \cong \sum_i (S_{ij} / S_j) \beta_{ij} \text{ with} \quad (12)$$

β_{ij} = beta associated with the equity of the i^{th} division of the firm

S_j = market value of the equity of the multidivision firm

S_{ij} = market value of the equity of the i^{th} division of the multidivision firm.

Since the market value, respectively the equity capital and the beta of a division are

not observable in the market a proxy has to be found. The pure-play method is based on the assumption that each pure-play firm is a “near perfect proxy” of its division in question. (Fuller 1981:999) It follows:

$$\beta_j = \sum_i (\hat{S}_{ij} / S) \hat{\beta}_{ij} \text{ with} \quad (13)$$

the symbol $(\hat{})$ denoting pure-play proxies.

The hypothesis of Fuller and Kerr is that if this relationship holds despite market imperfections reasonably well, then support for the pure-play technique as an acceptable procedure is given.

In the study, carried out in the years 1976, 1977 and 1978 the sample included 1700 firms. 60 multidivision firms with 142 divisions could be identified. Thus, 142 pure-play firms had to be found. The selection criteria for the pure-play firms were focused on operating characteristics. Financial leverage was not considered in the first place, because it would have significantly reduced the sample size and the adjustment for leverage can be carried out later on. The criteria for choosing a pure-play firm as a proxy for the division from the stocks followed by the company Value Line were the following:

- The firm had only one business line
- The pure-play was in the same industry or business line
- The revenues were approximately the same as those of the division
- When geographical factors were considered to be important, pure-plays operating in the same geographical areas were selected
- The firm with the median beta was selected if several pure-play firms could be identified. (Fuller 1981:1000)

Of the identified pure-play firms the published beta, which was derived by the company Value Line, was taken and the division's sales divided by the sales of the entire firm were used as the weight for each division (\hat{W}_{ij}) . Consequently the hypothesis was tested in calculating the difference between the observed multidivision firm's beta β_j and its weighted average pure-play proxies:

$$\Delta_j(\beta) = \beta_j - \sum_i \hat{W}_{ij} \hat{\beta}_{ij} \quad (14)$$

For the total sample a mean absolute relative difference of 8.9% was calculated, thus, proxy betas were on average within plus or minus 9% of the observed betas. The outcome of the regression, shown in figure 7, supported the hypothesis of Fuller and

Kerr. Accordingly, the beta for a multidivision firm is a weighted average of its pure-play's divisional betas.

As stated before Fuller and Kerr (1981) focused on operating characteristics and did not consider financial leverage when selecting pure-play companies. Since the capital structure has an influence on beta there are several methodologies to take into account the previously ignored capital structure.

Summary Statistics for Differences in Betas				
	1976 Sample	1977 Sample	1978 Sample	Total Sample
Multidivision Beta (β_j): Mean	1.036	1.030	1.020	1.030
Standard Deviation	0.153	0.333	0.234	0.251
Pure-Play Proxy Beta*: Mean	1.011	1.046	0.981	1.017
Standard Deviation	0.083	0.294	0.183	0.208
Mean Difference, $\Delta(\beta)$	0.025	-0.015	0.039	0.013
Standard Deviation of $\Delta_j(\beta)$	0.132	0.105	0.113	0.118
Number of Positive $\Delta_j(\beta)$	9	11	9	29
Number of Negative $\Delta_j(\beta)$	13	12	6	31
Mean $AR\Delta(\beta)$	9.5%	7.9%	9.4%	8.9%
Median $AR\Delta(\beta)$	7.7%	5.3%	9.1%	6.7%
Number of Observations	22	23	15	60
Regression (based on 60 observations)				
$\beta_j = -0.055 + 1.067$ (Pure-Play Proxy) $r^2 = .78$				
* Pure-Play Proxy Beta = $\sum_i W_{vi} \hat{\beta}_{vi}$				

Figure 7: Summary statistics of differences in betas (Fuller 1981:1003)

To consider the differences in the capital structure between the pure-play firm and the multidivision firm a method similar to that suggested by Hamada (see chapter 3.2) which involves unlevering the pure-play beta and afterwards relever the unlevered beta taking into account the capital structure of the multidivision firm in question, was used in the study. Consequently, the for the capital structure adjusted proxy beta should more closely approximate the observed multidivision firm's beta. The empirical results contradict the theory, because it turned out that unadjusted betas provided closer approximations than the adjusted ones (see appendix table 1). The adjusted betas were calculated either using market values or book values but none of them revealed better result than the unadjusted betas. After analyzing the equity capital the debt component was taken into consideration. According to Fuller and Kerr (1981) the differences in the overall cost of capital of the multidivision firm and the pure-play proxy cost of capital were caused almost entirely by differences in the debt ratios. They tested if the debt ratio of the pure-plays can be used as a proxy for the division's debt ratio. The results suggest that the debt ratio of the pure-play firm should not be used as a proxy for the debt ratio of the division. Finally, Fuller and Kerr (1981) conclude that

the most appropriate procedure for estimating the cost of capital for a division is to use the pure-play beta to estimate the divisional beta and consequently the divisional cost of equity capital. For determining the divisional cost of debt it is suggested to use the overall cost of debt for the firm and the target debt ratio should be internally-created. (Fuller 1981:1002pp.)

4.1.1.2 Criticism of the pure-play method

The principal criticism that the pure-play method has to face is the problem of identifying appropriate pure-play firms. Critics state that it is nearly impossible to find a pure-play with a perfect match. They argue that few divisions have perfect analogies. (Bower/Jenks 1975:47) (Myer/Nyerges 1994:47) The fact that Fuller and Kerr (1981) were able to find only 60 multidivision firms with their 142 divisions out of the sample of 1700 leads to the argument that the method has limited applicability (Kulkarni/ Powers 1991:497). Even the argument of Fuller and Kerr (1981) that the actual application will be easier and wider since the manager of the division has a better knowledge of the industry and the competitors, does not convince critics of the pure-play method. Additionally, it is argued that the terms industry, division, pure-play and industry segment are not described precisely enough and thus misleading in the sense that when speaking of divisional cost of capital it would be more appropriate to speak of the required rate of return for an industry segment, because segments represents the proper sub-units of analysis and the terminology is also used in a firm's accounting report (Boquist/Moore 1983:12).

Other critical issues refer to the use of the pure-play industry method. On the one hand it is argued that it ignores the information in multidivision firms or conglomerates because it evaluates only companies operating in a single line of business. This exclusion creates a bias if an industry beta is calculated, because betas of large-market capitalization firms tend to be lower than the ones of small capitalization firms. This implies that estimated industry pure-play betas are potentially upward biased. (Kaplan/Peterson 1998:86) Conversely, Kulkarni (1991:509) argues that industry market betas will have less potential for measurement error since they do not use single-firm experience but market data from conventional industry groupings. The problem is that multiproduct firms also incorporate the risk of unrelated products. That is why the product line in question might not be properly represented.

Fuller and Kerr (1981) warn that the observation made in their study that differences in the capital structure can be disregarded has to be viewed with caution since they are aware of the various studies that verified the positive relationship between systematic risk and leverage. Conine and Tamarkin (1985:55) argue in this context that the Hamada formula used by Fuller and Kerr ignores that corporate debt and preferred stocks are risky in the CAPM framework and this could bias their results. They suggest a refinement of the formula for the leverage adjustment. The observation that unadjusted betas provide better results than those adjusted for the capital structure was reversed by a more recent study of Chua and his colleagues (2006). Their results reveal that divisional beta estimates that were adjusted for the capital structure provided better estimates than unadjusted ones. As a result they conclude that adjusting for leverage improves the estimates as well as it is conceptually superior. (Chua 2006:60pp)

4.1.2 The accounting beta method

If it is impossible to indentify publicly traded single-product line companies, accounting data can be used to estimate beta. As discussed before, betas are normally established by running a regression of the returns of a firm's stock against the returns on a stock market index. Similarly it is possible to estimate so-called accounting betas by regressing a division's accounting return on assets against the average return on assets for a large sample of companies (Brigham 2008:363). Consequently, a variable calculated using accounting data is substituted for the firm's stock return and its averaged values over a large number of firms is substituted for the market index returns in the regression model (Myer/Nyerges 1994:47).

The accounting method presented in the following is according to the paper of Gordon and Halpern (1974) who were one of the first in using accounting data to develop a model for calculating the cost of capital for a non-traded firm or a division. The model bases on the same theoretical background as the pure-play method, namely the CAPM. Accordingly, the cost of capital of a project depends on the systematic risk of the project which deviates from the overall company cost of capital if the systematic risk of the project and the firm differ. Again the problem of measuring the unobservable systematic risk of a project or division arises. In comparison to the pure-play method an accounting analogue for the market beta is used to measure the systematic risk.

The starting point is looking at the rate of return for the non-traded company or division as if it were publicly traded as (compare chapter 3.1.2):

$$k_s = r_f + [E_{(rm)} - r_f] \cdot \beta \quad \text{with} \quad (15)$$

r_f = the risk-free rate of return

$E_{(rm)}$ = the expected rate of return on the overall market portfolio

$E_{(rm)} - r_f$ = the market risk premium

β = the systematic risk of the equity.

Recalling from chapter 3.1.2.2 beta is usually estimated as the slope coefficient of the market model of returns:

$$R_{it} = \alpha_i + \beta_i (R_{mt}) \quad \text{with} \quad (16)$$

R_{it} = return on stock i in time period t ,

R_{mt} = return on the market portfolio in period t ,

α_i = regression constant for stock i

β_i = beta for stock i .

Since share prices for estimating the return are not available for divisions another way to estimate beta has to be found. Gordon and Halpern specify a statistic \hat{c}_i based on non-market data which is highly correlated with β_i .

$$\text{Accordingly, } \hat{\beta}_i = \lambda_0 + \lambda_1 \hat{c}_i. \quad (17)$$

If this equation holds and \hat{c}_s can be observed, then using the CAPM formula leads to the yield at which a stock of a division would sell if it would be publicly traded. The estimate of $\beta_s, \hat{\beta}_s$, is provided by the observable parameter \hat{c}_s which is derived from non-market data. Consequently, for the s^{th} division of firm i , the rate of return is given

$$\text{by: } \hat{k}_{is} = rf + \hat{\beta}_{is} [E_{(rm)} - rf] \quad \text{where} \quad (18)$$

$\hat{\beta}_{is}$ is given by formula (17) and \hat{c}_{is} is obtainable from non-market data of the division s . After substituting for $E_{(rm)} - r_f$ in formula (18) and substituting the estimates for $\hat{\beta}_i$ and $\hat{\beta}_{is}$ according to equation (17) the return at which a division s would sell, having the same financial policies and tax circumstances as the company, is:

$$k_{is} = rf + \frac{\lambda_0 + \lambda_1 \hat{c}_{is}}{\lambda_0 + \lambda_1 \hat{c}_i} [k_i - rf]. \quad (19)$$

The next step is finding the appropriate measure of systematic risk that is based on non-market data and highly correlated with beta.

The association between market and accounting based risk measures was studied among others by Breaver and his colleagues (1970) who found that accounting data also reflects the riskiness among securities which are mirrored in the market prices of them. They suggest that accounting measures can be used for decision making when market-based risk measures are not available like in the case of divisional cost of capital. The positive relationship or the co-movement between the earnings of a firm and the earnings of the market is considered to be an accounting-based or non-market based measure of the systematic risk of a firm.

Gordon and Halpern use the rate of growth in earnings as variable to measure the systematic risk:

$$g_{it} = \hat{\alpha}_i + \hat{c}_i g_{mt} \quad \text{with} \quad (20)$$

g_{it} = the rate of growth of income for firm i in period t

g_{mt} = the rate of growth of income on a diversified portfolio of firms in period t .

Consequently, \hat{c}_i is estimating the covariance-variance ratio of the company's rate of growth in income and the growth of income of a diversified portfolio of firms, which can be compared to the definition of beta in the CAPM framework described in formula (5a). Consequently formula (20) also applies for non-traded firms or divisions. According to Gordon and Halpern β and c can be considered as highly correlated because of the following: Considering the assumptions that

- the rate of return that investors require is constant over time,
- all earnings are paid in dividends and
- the actual value of earnings in the beginning equals the expected earnings in every period.

Then, if the earnings of a company grow at a constant rate the price as well as the dividend will grow at the same constant rate over time.

Since the realized earning's growth rate and the realized return on the share will not be constant the fluctuations in the realized return on the share will be accounted for by fluctuations in the realized price per share growth rate and in turn be highly correlated with the fluctuations in the earning's growth rate.

Gordon and Halpern illustrate this with the following formula:

$$\begin{aligned} \tilde{g}_t &= \frac{[\tilde{X}_t - iB](1-T) - [X_{t-1} - iB](1-T)}{[X_{t-1} - iB](1-T)} \\ &= [\tilde{X}_t - X_{t-1}] / [X_{t-1} - iB] \quad \text{with} \end{aligned} \quad (21)$$

X_t = earnings before interest and taxes

T = tax rate

$i_t B_t$ = interest payment on outstanding debt (for simplicity are both factors considered constant over time).

The dividend in t is:

$$\tilde{D} = (\tilde{X}_t - iB) \quad (22)$$

and the share price at the end of t is:

$$\tilde{P}_t = \tilde{D}_t / k. \quad (23)$$

Consequently, the realized return in period t is:

$$\tilde{R}_t = \frac{\tilde{D}_t + \tilde{P}_t - P_{t-1}}{P_{t-1}} \quad (24)$$

$$\begin{aligned} &= \frac{(\tilde{X}_t - iB)(1-T) + \frac{[\tilde{X}_t - iB](1-T)}{k} - \frac{[X_{t-1} - iB](1-T)}{k}}{[X_{t-1} - iB](1-T) / k} \\ &= \frac{(\tilde{X}_t - iB)k + \tilde{X}_t - X_{t-1}}{X_{t-1} - iB}. \end{aligned} \quad (25)$$

Comparing formula (25) and (21) it is shown that the rate of return and the earning's growth rate differ only by the factor $(\tilde{X}_t - iB)k$ which is considered to be very small and stable. Gordon and Halpern argue that for arriving at formula (25) a lot of assumptions have been taken but these are not critical to the assertion that \tilde{g}_t and \tilde{R}_t will be highly correlated. Thus, if the growth rate of earnings and the realized rate of return of a company correlate than this should be true for all firms and consequently,

β_i and c_i will be correlated. This means that an accounting based measure of systematic risk, c_i can be used as an estimate of beta.

4.1.2.1 Empirical evidence of the accounting beta method

There have been a lot of studies trying to empirically validate the accounting beta method. Unfortunately, the results are contradicting and there seems to be no consensus about the underlying accounting return measure. Breaver and his colleagues (1970) found among other researchers a significant correlation between an earnings-price beta and the stock beta. Hill and Stone (1980) argue that this measure cannot be seen as a pure accounting measure since it does not depend on accounting data alone. The discrepancy and unsatisfactory results of previous studies have moved Hill and Stone (1980) to carry out an extensive study. An important matter in their analysis is the incorporation of the financial structure since previous studies did either not explicitly deal with this topic or reveal contradicting results. Their study is discussed in the following. Their purpose was to find the so-called *risk-composed equity beta*, an accounting measure of systematic equity risk consisting of an accounting measure of systematic operating risk and the financial structure. The study was carried out from 1947 to 1974 and covers 28 years. 150 firms were found that fulfilled all the necessary criteria, like full data availability. Hill and Stone (1980) analyzed and compared different types of equity betas. The used alternatives of betas with their formulas are shown in figure 8. Four types of accounting-based and two market-based measures of systematic risk have been analyzed. The formula for the *risk-composed equity beta*, β_i^R is expressing the accounting equity beta as a function of β_i^O , the operating risk and an accounting measure of financial risk. Hill and Stone (1980) found that adding company-specific financial structure increases the ability to explain market betas. The correlations tests show that the *risk-composed equity beta* has a significant positive association with the market beta and is competitive or even superior with the covariance-based equity beta and definitively superior to the income beta.

To summarize, the tests show that accounting data in conjunction with the risk-composed computation is able to explain market betas, thus it is an alternative to the usual covariance measures previously used to estimate accounting equity betas. Consequently, it is a useful tool in estimating accounting betas.

NAME	SYMBOL	RETURN MEASURE	BETA FORMULA
OPERATING BETA	β_i^0	$ROA_i \equiv \frac{OE_i}{TA_i} = \frac{\#13 - \#14}{\#6}$	$\frac{Cov (ROA_i, ROA_M)}{Var (ROA_M)}$
INCOME BETA	β_i^I	$IR_i \equiv \frac{NI_i + NON_i}{TA_i} = \frac{\#18 + \#17}{\#6}$	$\frac{Cov (IR_i, IR_M)}{Var (IR_M)}$
COVARIANCE-BASED EQUITY BETA	β_i^C	$ROE_i \equiv \frac{NE_i + NON_i}{CE_i} = \frac{\#20 + \#17}{\#11 + \#33}$	$\frac{Cov (ROE_i, ROE_M)}{Var (ROE_M)}$
RISK-COMPOSED EQUITY BETA	β_i^R	— — — — —	$\left(\frac{\beta_i^0}{1-f_i} \right) \left[\sum_{k=1}^N \frac{w_k \beta_k^0}{1-f_k} \right]^{-1}$
MARKET BETA (MONTHLY RETURNS)	β_i^M	$R_i \equiv \text{monthly market return}$	$\frac{Cov (R_i, R_M)}{Var (R_M)}$
MARKET BETA (ANNUAL RETURNS)	β_i^{MA}	$R_i^A \equiv \text{annual market return}$	$\frac{Cov (R_i^A, R_M^A)}{Var (R_M^A)}$

Figure 8: Alternative betas and their associated return measures (Hill/Stone 1980:609)

4.1.2.2 Criticism of the accounting beta method

Erhard and Bhagwat (1991) criticize in their paper several previously published analyses of the accounting beta method. They argue that although Hill and Stone (1980) report statistically significant correlations between the accounting-based and market-based measures, these correlations are very low. The correlations range from 0.156 to 0.351. Also the study of Rosenberg and McKibben (1973) who similar to Breaver and his colleagues (1970) used both market and accounting information to estimate the systematic risk, is assessed to be inappropriate for estimating divisional betas since the method depends on market data which is not available for divisions. The model of Kulkarni and his colleagues (1991) that was created to estimate divisional betas is criticized for its inability to be empirically tested since there is no possibility to compare the estimated divisional accounting with corresponding market betas because again the problem of unobservable divisional market betas arises.

Consequently, it seems that there are still a lot of problems associated with the accounting beta approach since a lot of questions are either not answered theoretically

or empirically and the analyst or manager is left with a lot of choice options, for example which measure of accounting return should be taken.

4.2 Subjective method

The subjective method is, as the name predicts, partly based on the subjective judgment of management. A survey of Block (2003) showed that the clear majority of firms in practice found their risk determination on subjective factors. Consequently, the objective measures, previously described, that are consistent with the finance literature are of lower importance than the subjective method in practice. This topic will be discussed in the next chapter.

Generally, there is no theoretical finance theory underlying the method. The matter of question is how management judge and weight the factors that influence or determine the risk of projects. Gup and Norwood (1982) have surveyed these factors and developed an approach which is known as the subjective method. A firm-specific example of how a company determines and measures the risk of a business segment or division is given and at the same time a model that can be adapted by any firm is established.

The paper of Gup and Norwood (1982) presents a completely different method compared to all the theoretical methods that use especially the CAPM to estimate the divisional risk. A practical approach in determining the divisional cost of capital is described on the example of Fuqua Industries by Benton E. Gup, a university professor and Samuel W. Norwood, the vice president of the company Fuqua Industries. The method that is used by Fuqua Industries for estimating divisional cost of capital incorporates objective as well as subjective risk measures.

Initially, the method is presented in a general form describing the several steps in the estimation of the risk components showing how it can be imitated by any firm. Afterwards the approach is illustrated in more detail on the example of Fuqua Industries.

Generally, the estimation involves three steps. The first step is calculating a combined risk class which includes an objective and subjective risk component. The second step involves assigning each class a number which refers to establishing a risk index. As a third and last step, the corporate cost of capital is multiplied by the risk index in order to derive the divisional cost of capital. Specifically, the objective component of the first step is measured with the variance in profits of the division in

question. The subjective risk is derived by ranking the risk elements that do apply. This involves that management creates a list including potential risk factors that belong to the division. Obviously the included risk factors will vary among companies. Averaging the objective risk and the subjective one gives the combined risk class. The risk index is derived using the cost of capital of competing firms in the industry which are ranked according to their cost of capital from low to high. Multiplying the risk index, in which the combined risk class lies, with the corporate cost of capital is resulting in the divisional cost of capital that take into consideration the risk characteristic of the division. (Gup/Norwood 1982)

This process is now illustrated in detail on the example of Fuqua Industries. The firm is operating as a manufacturing, distribution as well as service company with a vast variety of products ranging from broadcasting to yoghurt. The company is listed on the New York Stock Exchange and runs 22 divisions.

The necessity of different cost of capital for the several business segments was recognized by the company because of the diverse nature of them. The divisional cost of capital determination involves estimating the corporate or company cost of capital, objective and subjective risk and a risk index. Thus, the corporate cost of capital is adjusted by the objective and subjective risk as well as the risk index to fulfill the different levels of risk throughout the various divisions.

The level of risk is determined by the average of the objective and subjective risk which amount to the “combined risk class” for each division.

25% weight + 75% weight = 100%					
Risk Class	Comparison of Actual NOPAT to Previous Year	Division	Comparison of Actual NOPAT to Budget Projections	Division	Total
1 Low	- 5% to +10%	2	- 3% to + 5%	1	.75 × 1 = .75
2	-10% to +20%		- 5% to +10%		.25 × 2 = .50
3 Medium	-15% to +40%		-10% to +20%		
4	-20% to +60%		-15% to +30%		
5 High	-25% to +70%		-20% to +40%		
			Average Objective Risk Class		1.25

Figure 9: Objective risk measurement by profit variance (Gup/Norwood 1982:21)

Each of these combined risk classes is assigned a risk index which multiplied with the corporate cost of capital result in the divisional cost of capital. The objective risk is measured with the variance in profits. This process is shown in figure 9.

Specifically, the current net operating profits after taxes, NOPAT, are compared to both the previous year and the budget for the current year. The emphasis is set on

variance from budgeted performance because a 75% weight is placed on this in comparison to the 25% weight that is given to the year to year variances. Consequently, also the so-called objective risk is based on judgment since the weights are distributed according to the management's decision.

The objective risk is found multiplying the weights by the appropriate risk class for the budgeted and actual variance and summing up these values. The subjective risk measurement process involves establishing a so-called annual "Division Risk Profile" which is a table that lists factors that are considered to be important for evaluating the risk of a division. These so called risk elements are ranked and assessed with values ranking from low to high by management according to their "Risk Class". Figure 10 shows this Division Risk Profile on the example of a division of Fuqua Industries.

Risk Elements	Not Applicable	Risk Class					
		Low 1	2	Medium 3	4	High 5	
1. Customer Base Dispersion	X						T O T A L S C O R E
2. Operational Flexibility			2				
3. Loss of Asset Value				3			
4. Cyclical Business		1					
5. Seasonal Business					4		
6. Government Involvement				3			
7. Changes in Technology		1					
8. Market Position						5	
9. Management		1					
10. Brand Distinction					4		
11. Unionization				3			
12. Environmental Impact		1					
13. Availability of Resources			2				
14. Backlogs						5	
TOTALS	X	4	4	9	8	10	35
Average Subjective Risk Class = $\frac{\text{Total Score}}{\text{Number of Applicable Risk Elements}}$							
= $\frac{35}{13}$							
= 2.69							

Figure 10: Example of a Division Risk Profile (Gup/Norwood 1982:22)

The total is calculated by summing up all the risk class values. Consequently, the combined risk class can be calculated by averaging the previously established objective and subjective risk class. Finally, the risk index has to be determined to be able to calculate the divisional cost of capital. The risk index compares the cost of capital of a specific firm to other firms in the industry. In this case, the management estimates the cost of capital of competing firms that are operating in the same lines of business as the division in question and compares it to the cost of capital of Fuqua Industries. After having estimated the cost of capital of the competition which involves making several assumptions, (see Appendix table 2) the calculated cost of capital rates

are divided by the one of Fuqua Industries resulting in the risk index. Thus, the risk index is a multiple of the cost of capital of Fuqua Industries and is ranked from low to high. This process is repeated for each line of business. Consequently, the risk of each division depends also on the riskiness or cost of capital of various competing firms relative to the cost of capital for Fuqua which is reflected in the risk index. Finally, the divisional cost of capital can be calculated multiplying the risk index with the corporate cost of capital. Figure 11 shows this last step in calculating divisional cost of capital.

	Combined Risk Class (1)	Risk Index (R) (2)	Division's Cost of Capital (3) = (2) × 12% = k_{Div}
Low	1	.90	10.8
	2	.97	11.6
Medium	3	1.05	12.6
	4	1.10	13.2
High	5	1.20	14.4

Figure 11: Divisional cost of capital on the example of a specific division of Fuqua Industries (Gup/Norwood 1982:23)

Considering the example of the previously discussed division of Fuqua Industries would have the following divisional cost of capital: As depicted in figure 9 and 10 the combined risk class is:

$$\frac{ObjectiveRisk + SubjectiveRisk}{2} = \frac{1.25 + 2.69}{2} = 1.97 \quad (26)$$

Thus, the division can be considered to be in a relatively low risk class, approximately risk class 2. Looking at figure 11 and assuming that the corporate cost of capital is 12%, allows us to calculate the divisional cost of capital as the following:

$$DivisionalCostofCapital = 0.12 \times 0.97 = 0.1164 \quad (27)$$

Consequently, the division's cost of capital lie slightly below the corporate cost of capital of Fuqua Industries. (Gup/Norwood 1982)

4.2.1 Empirical evidence of the subjective method

In the empirical study of Block (2003) which will be discussed in detail in the next chapter survey respondents had to rank the subjective risk factors that were listed by Gup and Norwood (1982) in their "Division's Risk Profile". The average ranking of the fourteen risk factors that influence management's judgment is shown in figure 12.

Average Ranking of Fourteen Risk Factors		
1.	Seasonal business considerations	2.8
2.	Unionization	3.5
3.	Environmental impact	4.1
4.	Cyclical business considerations	4.2
5.	Loss of asset value	4.7
6.	Government involvement or interference	4.9
7.	Change in technology	5.1
8.	Brand distinction	5.8
9.	Exposure to backlogs	7.2
10.	Management failure	8.9
11.	Market position	10.1
12.	Customer base dispersion	10.6
13.	Operational Flexibility	11.2
14.	Availability of Resources	12.4

Figure 12: Ranking of subjective risk factors included in the "Division's Risk Profile" (Block 2003:354)

The most important factor related to risk for respondents is the availability of resources followed by operational flexibility, customer base dispersion and the market position. The factors that were considered to be least important are seasonal business consideration, unionization, environmental impact and cyclical business consideration.

Even if consensus on several factors can be found it is obvious that the risk profile of companies will differ, especially among different industries.

4.2.2 Criticism of the subjective method

The objective methods are far more consistent with the literature because there is no financial theory underlying the subjective method. Since every aspect is based on judgment it is hard to provide conclusive proof and to make comparisons. Even the so-called objective part in the Gup-Norwood method which is measured by the variance in profits is partly based on subjective judgments since management has to weight the importance of the actual variance and the variance in comparison to the budget.

Maybe the hardest task is to develop an appropriate risk profile or rather to rank the elements according to their importance. This process is time consuming and involves a good understanding of the micro and macro environment of the company.

The calculation of the risk index as shown by Gup and Norwood (see Appendix table 2) is also questionable since there are several assumptions made. For example, when calculating the cost of capital of competing firms, it is assumed that the firm's capital structure is 50% debt and 50% equity. Since it is very likely that not every company has a capital structure with debt and equity equally weighted the outcome might be biased. Further, the risk index is comparable to the pure-play method and its associated problems. Finally, the outcome of the cost of capital depends very much on the decisions and thus the competence of the management.

4.3 Comparison of the methods

The pure-play method involves an understanding of the operations of the divisions in question as well as a good knowledge about the competitors. Managers fulfilling these requirements face the problem that their competitors might be diversified corporations operating in several lines of business. Nevertheless, if it is impossible to find a firm operating in exactly and solely the same line of business the alternative of using the beta of the industry average as proxy still exists. The application of the approach, if proxy betas can be found, is easy to handle and to communicate. Even if the approach of the study of Fuller and Kerr (1981) has several limitations especially considering the financial leverage adjustments, empirical evidence could be given.

Empirical evidence is also given for the accounting beta method but not on the divisional level. In this context the pure-play method can be considered as superior. The advantage of the accounting beta method is definitely the fact that it is not restricted to the availability of information like in the case of the pure-play approach. Since only data of the firm in question is needed there are no limitations according to the data availability, thus it is applicable for every division or segment. The limitations of both methods have lead to the development of several other approaches like the goal programming and the full-information method. Since these methods are hardly known and even less if at all used in practice they are not discussed in detail.

The full-information approach can be considered as an extension of the goal programming method which was published by Boquist and Moore (1983). The full-information approach was developed by Erhard and Bhagwat (1991) and bases on the

theoretical observation that the beta of a firm is equal to the weighted average of the betas of its segment. It is argued that their method is not restricted to the availability of data because data requirements are easy obtainable and the statistical tool used is a simple regression, thus easy to administer. Consequently, according to Erhard and Bhagwat (1991:68) the full information approach is superior to the pure-play, the accounting beta and the goal programming approach.

This statement was reversed by Chua and his colleagues (2006:60) who found in their study about a comparison of different multidivisional beta estimates that pure-play estimates provide better results than estimates based on the full-information approach. Consequently, they argue that managers should prefer the pure-play approach if proxies are available.

The subjective method is hard to compare to the objective ones since it does not base on financial theory. Thus, it is hard to give theoretical and empirical evidence on the accuracy of the method. Nevertheless, all the objective methods that underlie financial theory are not heavily accepted in practice. Comparing usage rates the subjective method is definitely superior. This issue will be discussed in detail in the next chapter. Furthermore, the subjective method incorporates a lot of different aspects of risk factors. It takes into consideration the variation of returns as well as the specific risk factors that might threaten the division as well as the competition.

The next two chapters discuss the topic from a practical view point. Actual usage rates and the dispersion of the various methods in practice are discussed in more detail. First a general cross-sectional overview of the application in practice is given. Afterwards, in chapter 6, a closer look is provided giving firm-specific examples.

5 Use and acceptance of divisional cost of capital in practice

This chapter provides insights on the actual usage rates of divisional cost of capital and the dispersion of the previously discussed methods in practice. Consequently, the magnitude of the theory-practice gap in the context of risk-adjusted and specifically divisional hurdle rates is addressed.

A lot of research has been conducted on the topic of capital budgeting techniques and cost of capital used in practice. In some areas an unambiguous decline in the theory-practice gap can be observed, whereas some concepts in the financial literature are still hardly used by practitioners. Specifically, the application of present value techniques has significantly grown over the past years as reported by Graham and Harvey (2001) in their survey of about 400 chief financial officers. Approximately 75% of their respondents use always or almost always net present value, NPV or internal rate of return, IRR as their most frequently applied capital budgeting technique. Bierman (1992) reports an increase in the usage of the NPV method from 4% in 1955 to 85% in 1992.

As already reported in chapter 3, also the WACC and the CAPM are widely accepted. The WACC is used by the vast majority of companies. Ryan and Ryan (2002) state that 83% of participants consider the WACC as the most appropriate discount rate. This is in line with the findings of Block (2003) who find a majority of 85% using the WACC. Graham and Harvey (2001) report that the CAPM is, with 74% of respondents, by far the most widely used method to estimate the cost of equity capital. Bruner and his colleagues (1998) even find a percentage of 85%.

Nevertheless, Graham and Harvey (2001) conclude that despite companies are using sophisticated evaluation techniques, it might be the case that some do not apply the techniques correctly since a surprisingly high number of firms use only their firm-wide discount rate to evaluate a project that likely has different risk attributes. Block (2003) has analyzed this topic in his study about the use of risk-adjusted hurdle rates which will be discussed in the following.

Block (2003) has surveyed 298 companies of the Fortune 1000 largest US corporations about their capital budgeting procedures and especially about their use of divisional cost of capital. The question "Do you have different required rates of return that are required for different divisions, subsidiaries or projects of the firm?" was positively answered by only 46.6% of the participants. These results show that in 2003

not even 50% of firms use risk-adjusted hurdle rates. The percentage of firms using risk-adjusted hurdle rates might even be lower considering small firms, because the research of Graham and Harvey (2001:232) suggests that in general small firms use less sophisticated methods to evaluate risky projects. The significance of the size of a company in this context was also researched among others by Payne and his colleagues (1999) who find similar results to those of Graham and Harvey.

5.1 The use of risk-adjusted hurdle rates over time

Comparing the outcome of the study of Block in 2003 to the survey of Brigham in 1975 the results are, if you consider the big time difference, surprisingly similar. Brigham (1975:19) reports that about one half of the respondents use multiple hurdle rates. An explanation for the relatively high use of risk-adjusted hurdle rates might be the fact that the companies that took part in the survey all participate in university programs and thus might be more familiar with academic literature. Consequently, it is not representative of the average company.

In 1982 a study of major US firms by Gitman and Mercurio (1982:25) showed that about 33.3% of major US firms use only a single cost of capital and do not specifically consider project risk. In 1991 Freeman and Hobbes (1991:38) report similar results to Block with about 47% that do not adjust their cost of capital according to project risk. Their participants were large companies in Australia.

	Use divisional cost of capital (%)	Use corporate- wide measure (%)
Energy	56.2	43.8
Technology	44.1	56.9
Manufacturing	60.2	39.8
Retail	39.9	60.0
Finance	55.7	44.3
Healthcare	56.2	43.8
Utilities	51.1	48.8
Transportation	47.2	52.7

Figure 13: A breakdown by industry of the use of divisional cost of capital (Block 2005: 62)

Trahan and Gitman (1995:79) found that 63.1% of companies in their sample of the Fortune 500 and Forbes 200 firms understand the importance of discount rate adjustments. Whereas, among the large firms in the sample a higher percentage of 70.7% and among the small firms a relatively low value of 46.2% was found. This is in

accordance with the previously named statement of Graham and Harvey (2001) that small firms use less sophisticated methods.

The subject in the questionnaire if CFOs want to know more about divisional cost of capital was answered positively by 24%.

In 1998 the study of Bruner and his colleagues asked if further adjustments are made to reflect the risk of individual investment opportunities. Only 26% answered with “Yes”, 33% with “Sometimes” and 41% with “No”. But 51% of the respondents state that they evaluate divisional performance. (Bruner 1998:18)

In a more recently study of Block in 2005, which studied the differences in capital budgeting within industries, 51.3% of the companies are using divisional cost of capital. Figure 13 shows the breakdown by industry of the use of divisional cost of capital and the use of a corporate-wide measure. But further analysis indicates no statistical significance between industry classification and divisional cost of capital. With the help of figure 14 the change of ignoring risk-adjusted hurdle rates and evaluating all projects on the basis of a single firm-wide cost of capital is illustrated. Except of year 1982 were the use of multiple or risk-adjusted hurdle rates is relatively high, since only 33.3 % evaluate all projects on the basis of a single hurdle rate, the change on average from 1975 to 2005 is not significant. The average use seems to be relatively constant over time. Considering the year 1975 and 2005 the percentage of firms that use a single rate is approximately the same. Comparing this to the fact that other capital budgeting techniques are widely accepted and nowadays used by the vast majority of companies, this is not true for the concept of risk-adjusted hurdle rates.

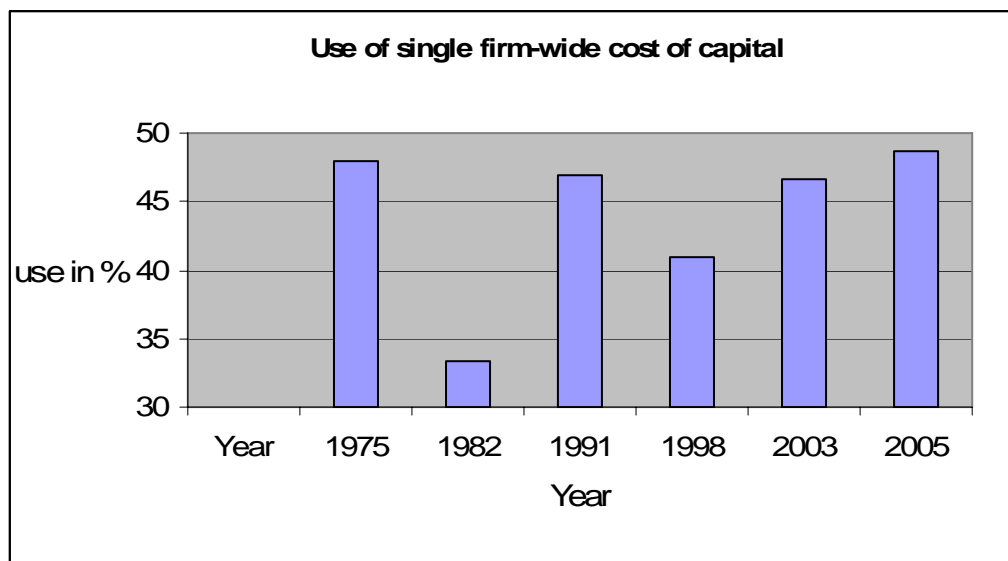


Figure 14: Use of a single firm-wide cost of capital over the years

This contradicts with the tendency of firms to become more and more diversified where the issue of multiple hurdle rates is even more compelling (Andrews/Firer 1987:65).

Even if it is hard to compare different studies because samples are usually dissimilar the comparison gives an idea about the average trend. All studies were carried out among large corporations and all except for one, that took place in Australia, were undertaken in the US.

After the acceptance of the concept in general has been pointed out the next step is to have a closer look on the methods that firms use if they actually do apply different hurdle rates. Block has studied the usage of different approaches to estimate divisional cost of capital which will be discussed in the following.

5.2 Methods used in practice to estimate divisional cost of capital

Block (2003) asked his survey participants by which method risk is measured. As previously stated only 46.6%, 139 of 298, of respondents use divisional cost of capital. Follow-up questions give insights into the approaches that firms actually use in practice to estimate risk-adjusted cost of capital and in this case divisional cost of capital. Of the 139 participants that stated that they use divisional cost of capital, 87%, thus the vast majority considers risk as the primary factor leading to an adjustment in the required rate of return. The second most important factor for the majority of respondents is the strategic importance of the division and as a third factor the division's ability to raise its own capital is mentioned. The listing of the three variables that determine the divisional cost of capital are shown in figure 15.

	Level of Importance		
	1 st	2 nd	3 rd
Risk	121	18	0
Strategic Importance of Division	18	100	21
Division's Ability to Raise It's Own Capital	0	11	110
	139		

Figure 15: Factors that determine divisional cost of capital (Block 2003: 351)

In the following the respondents that consider risk as the key variable are surveyed in detail. The academic literature offers a number of different approaches to estimate the

risk for a division. As already discussed in chapter 4, firms can rely on objective and subjective methods. The theory underlying the objective estimation using the pure-play technique or the accounting beta method, as well as the subjective method according to Gup and Norwood was already presented. Now the actual use of these methods in practice is of interest.

Of the 121 companies that estimate a divisional hurdle rate 29% use the pure-play method to determine their cost of capital. The majority of these 29%, namely 57% use a pure-play in the same line of business and 43% use an industry beta as the pure-play proxy. The accounting beta method is used by only 6% of total respondents. Thus, of the objective methods the pure-play method seems to be the most accepted one in practice. But in total the objective methods, thus the pure-play and the accounting beta method are applied by only 35%, thus approximately one third of companies use objective methods discussed in the literature. The remaining 65% use a subjective measurement. The subjective method, discussed in detail in chapter 4, is based on the management's view of perceived risk which is associated with the division. Consequently, it is obvious that a subjective measurement is by far the most accepted approach used by major US firms in practice. A summary of the responses about which method is used is given in figure 16.

METHODS USED IN PRACTICE		Responses
Pure-play method using a single line of business proxy beta	57%	29%
Pure-play method using an industry proxy beta	43%	
Accounting beta method		6%
Subjective measurement		65%
Total		100%

*Figure 16: Methods used in practice in 2003 among large US companies
(Adapted from Block 2003:353)*

Consequently, the objective methods proposed by the academic literature are not widely accepted. Considering that only about 50% of firms use divisional cost of capital

and of those only about one third use one of the objective measurement the theory-practice gap is obviously enormous.

Similar results were obtained in a study in the year 2000 of 146 multinational companies. The distribution of the objective measures is a little bit different, because the accounting beta method is used heavier than the pure-play method but the dominance of the subjective measurement is as clear as in the survey of 2003.

The question posed to the 146 companies how they measure the risk associated with a division or project provided three possibilities. The respondent could chose between the pure-play method using the beta of a public company in the same line of business, an objective measure that is not market-based such as the accounting beta method and a subjective measure based on management's judgment. The results are summarized in figure 17. (Block 2000:318p.)

METHODS USED IN PRACTICE	Responses in %
Pure play method using the beta of a public company	9%
Accounting beta method	15%
Subjective measurement	76%
Total	100%

Figure 17: Methods used in practice in 2000 (Adapted from Block 2000: 318)

The subjective method is with 76% even more dominant than in 2003. The ranking of the objective measurements has changed. More respondents indicated that they use a non-market related measure. Nevertheless the importance of objective methods is, similar as in 2003, relatively low. With only 24% of companies using an objective measurement the acceptance and usage rate is even below the one in 2003.

Block (2000:319) found in his survey that 82% of companies that explicitly take risk into account use the risk-adjusted discount rate approach instead of the certainty equivalent approach.

As discussed in the beginning in chapter 2.1 only systematic risk should be compensated using a risk-adjusted discount rate. Nevertheless, Block documents that less than 15% of his survey participants distinguish between systematic and unsystematic risk. This might explain the low usage rate of objective methods since

they are all based on the estimation of the systematic risk. Nevertheless, it seems confusing considering the observation made by Pike (1996:84p.) in his longitudinal study about capital budgeting practices, that the sharpest trend is found in risk assessment with an increase in the usage rate of formal risk analysis from 26% in 1975 to 92% in 1992.

As already stated in the beginning the use of a divisional hurdle rate is not necessarily restricted to divisions. Other criteria than the organizational unit could be the reason to group projects in order to evaluate projects with similar risk characteristics with the same risk-adjusted hurdle rate. A possibility is the grouping of different types of investments. The most obvious type that requires a different cost of capital because of its different risk characteristics is a foreign investment. This special case will be discussed in detail in chapter 7. Initially, it is shown which different types of investments are grouped and treated as one unity assessing one single hurdle rate to evaluate the set of projects.

5.3 Risk-adjusted rates for different types of investments

Instead of grouping projects according to organizational units like a division, there is the possibility for companies to sum up projects according to the type of investment. Block (2005:62) gives an example of how different types of investments are grouped in order to evaluate them with a risk-adjusted hurdle rate. The projects are arranged according to their level of risk, whereas, every type of investment is classified as belonging to a specific risk-adjusted discount rate. A specific type of investment that is considered to have low or no risk, like an equipment replacement, is assigned the minimum risk-adjusted discount rate. Completely new products or new products in a foreign market are considered to be the type of investment with the highest level of risk and thus the maximum rate is assigned to them.

Type of Investment	Discount Rate (%)
Low or no risk (equipment replacement)	6
Moderate risk (new equipment)	8
Normal risk (addition to normal products)	10
Risky (new product in related market)	12
High risk (completely new product)	16
Highest risk (new product in foreign market)	20

*Figure 18: Ranking or risk-adjusted discount rates according to investment type
(Block: 2005:62)*

The ranking of the different types of investments according to Block are shown in figure 18.

The distinction between hurdle rates for different organizational units and different types of investments was also made by Brigham in his survey in 1975. His aim was to test the use of multiple hurdle rates. Almost half of respondents use a single rate to evaluate all projects, this issue was discussed previously. Brigham (1975:19) found that companies that use more than one hurdle rate to evaluate their investments categorize projects in a specific manner and assess different risk-adjusted rates for these categories. If companies group investments according to different organizational units they categorize in subsidiaries, divisions, product lines and domestic vs. overseas. Whereas, categorizing according to investment types involves distinguishing between projects of replacement, expansion, old product lines and an expansion of new products. In the survey of Brigham (1975) 45% made a distinction between different organizational units and 35% use varying hurdle rates for different types of investments.

In the study of Freeman and Hobbes (1991:38) survey participant were also asked how they classify the risk of projects. A subjective measurement is the most common used method to assess the risk of an investment. 27% of respondents confirmed that they use a subjective method to evaluate risk in order to put them into one category. Projects are categorized as low, medium or high risk investments. The grouping with respect to the type of investment, to which the project belongs, is used by 23% of respondents. In this case investments are categorized according to the expenditure type into new products, expansionary and replacement investments.

Up to now a cross-sectional discussion of the use of several theoretical methods and other application issues are addressed in general. The focus was set on the actual distribution and application of the discussed methods on an aggregate level. In the following some firm-specific examples are presented to get some closer insights into the determinants of cost of capital estimation in practice.

6 Insights into firm-specific practices

This chapter gives a closer look on firm-specific practices in the context of divisional hurdle rate estimation. Insights are gained on the methods and their practical application on some chosen examples. The objective is not to generalize about application practices but to discuss the problems that arise in practice but also show the possibilities presenting a successful example.

The first part is based on a panel discussion published in the journal “Financial Management” in the year 1989. Four persons, Chief Financial Officers or the person responsible for the cost of capital estimation within the company, are giving insights about practical implications and discuss problems that arise during the estimation. Especially the issue of setting divisional hurdle rates is a matter of interest.

6.1 Panel discussion about divisional hurdle rates

The first statement is given by Mr. Gunn from Southwestern Bell, a large holding company with many subsidiaries. The panelist talks about the areas where the implementation of divisional hurdle rates is an important issue within Southwestern Bell. Mr. Gunn points out that the potential applications of different hurdle rates are in establishing a required rate of return for each subsidiary, for particular projects and for international opportunities.

In terms of hurdle rates for specific projects, the topic for Southwestern Bell is especially appealing when evaluating new products and services, projects in particular locations or on specific pieces of equipment.

The panelist states that the method used is “a CAPM type approach because the beta is readily available” (Weaver 1989:19). Thus, the company relies on the pure-play approach. Mr. Gunn states that the hardest point lies in identifying comparable firms that are single products firms and compete with the products offered by Southwestern Bell. Specifically, in their case it was possible to find data only for three business lines out of eight. The problem is that in some business lines the competitors are large companies and the business line in question cannot be isolated. Since the availability of data is very limited, Southwestern Bell has not incorporated a detailed divisional hurdle rate approach for new products. Mr. Gunn points out that the concept of divisional hurdle rates is appealing and Southwestern Bell is trying to apply it, if comparable firms can be identified.

The second panelist is Mr. Clemmens, Chief Financial Officer of Vulcan Materials Company, an international producer of industrial materials and commodity products. Before illustrating which form the cost of capital estimation takes within Vulcan Materials Company, Mr. Clemmens points out that “hurdle rates are important, but not as important as the looking at each project, understanding each strategy, and challenging the assumptions” (Weaver 1989:21). The method used by this company can be interpreted as a modified pure-play approach, because a divisional cost of capital is calculated using a pure-play industry beta that takes the targeted leverage into account but also a kind of correction factor called “shortfall” is incorporated that leads to the final divisional cost of capital. This shortfall is needed to account for too optimistic projections and tries to cover the average deficit that has been experienced so far by the division because of the difference between the actual implementation returns versus the projected rates of return.

The third panelist is Mr. Dannenburg from Digital Equipment Corporation. Since the operations of the company are in the area of product development and research and development is an area of uncertainty by nature the subject of multiple hurdle rates has been compelling. Risk varies across the spectrum of R&D from basic research to product development and is depending on the nature of the product, since traditional product lines are generally safer than non-traditional products where acceptance is particularly uncertain. Digital has developed a matrix concept to group the different types of projects into categories. The X-axes of the matrix represents the development categories. The level of risk increases from low for product development to moderate for advanced development and finally to high for basic research. The Y-axes represents the type of product where risk increases from low for traditional products to high for non-traditional products.

The average project with normal risk is the development of a new product within a traditional product line which is based on already established technology. These average projects are evaluated with the firm’s WACC. Projects that lie outside the range of normal risk in the matrix are assessed with a different cost of capital rate. Digital Equipment Corporation uses the pure-play technique to estimate the systematic risk of these non-normal risk projects. They identify a single-product line proxy beta, adjust it for leverage and use the CAPM and WACC formulas to determine the risk-adjusted cost of capital.

To overcome the problem of not being able to identify pure-play firms, Digital designs a risk class schedule for the firm in order to evaluate its product development projects. Several companies with similar technological risk are identified and for each

of them a leverage adjusted beta is established. These companies are then grouped according to their product type and ranked by the risk level in order to cluster similar betas, calculate an average beta per product line type and establish several risk-adjusted cost of capital classes, depending on the speculative nature of the product line. Mr. Dannenburg concludes that their system of combining theories helps the company to improve project selection decisions and provides an accurate financial evaluation of a development project.

The fourth panelist is Mr. Weaver from Hershey Foods who gives an overview about current and future targeted cost of capital estimation. The current cost of capital estimation is based on divisional hurdle rates which are calculated using a modified "Gup-Norwood" approach. Thus, the divisional hurdle rate estimation is derived from the company cost of capital adjusted for a premium for divisional risk, which is calculated according to the subjective method introduced by Gup and Norwood and additionally a surcharge for support projects is imposed by Hershey Foods. Support projects are on the one hand administrative projects like an office building and on the other hand environment control or R&D projects. But Mr. Weaver states that the methodology is in an evolutionary state which has to be improved. That is why a task team has already been hired to review not only the divisional hurdle rate methodology but division and project hurdle rates. The targeted system is similar to that previously introduced by Mr. Dannenburg. Consequently, a number of categories of projects with different risk profiles have been established within Hershey Foods and different hurdle rates have been attached to each category. Up to this point the hurdle rate estimation did not follow an objective approach. Senior management's desires about required rates of returns formed the guideline for going forward.

To conclude Mr. Weaver states that what corporations need is a methodology that solves the issue for managers which rate of return is appropriate for a particular project at a given risk level (Weaver 1989:18pp).

Comparing the panel discussion with the literature, the pure-play approach and the subjective approach seem to be accepted and used among financial managers. Nevertheless each firm uses the theory more or less as a basis and adjusts the different methods with firm specific factors. The grouping of projects in categories with different risk levels might for practitioners be more important than the handling of divisional hurdle rates. An appropriate measure for classifying projects into categories independent from the categorization criteria like an organizational unit or a specific type of investment, is a challenge for researchers.

6.2 Motorola Corporation

The paper of Collier and his colleagues (2007) shows the example of using the pure-play method to calculate a divisional hurdle rate for a specific segment within the Motorola Corporation which is described in the following. The company is a global manufacturer of technical products like communications products, semiconductors and electronic solutions operating in six different segments that publicly report financial results. One of the smaller segments is the Integrated Electronics System Segment (IESS) that designs, produces as well as markets automotive and industrial electronic systems and components which made up 7.6% of sales for 2002.

The overall company cost of capital for Motorola Corporation is 12.3% which reflect the risk of a typical investment project. The cost of capital for the IESS division is:

$$\beta_{equity} = \left[1 + (1 - T) * \frac{B}{S} \right] * \beta_{unlevered} \quad (28)$$

It is assumed that the division has the same capital structure as the company. Thus the debt to equity ratio, $\frac{B}{S}$, is 42% and the corporate income tax rate is 34%. For a listing of the detailed costs see appendix table 3. The beta is derived from listed competing companies that primarily operate in supplying the automotive industry. The list of the different competitors with their equity and unlevered betas is shown in figure 19.

Firm	Symbol	β_{equity}	Market price	Shares outstanding (million)	Equity (million)	Debt (million)	Debt/Equity ratio	$\beta_{un-levered}$
Borg-Warner	BWA	0.93	53.18	26.9	1431	648	0.45	0.72
Delphi	DPH	0.67	8.00	558.1	4465	2084	0.47	0.51
Johnson controls	JCI	0.88	79.07	89.0	7037	1527	0.22	0.77
Lear	LEA	1.21	38.08	65.7	2502	2135	0.85	0.77
Magna	MGA	0.51	57.18	90.3	5163	231	0.04	0.5
Visteon	VC	1.31	6.56	129.0	846	1298	1.53	0.65
Average								0.65

Figure 19: Equity and unlevered betas of suppliers in the automotive industry (Collier, 2007:1230)

The average un-levered beta is 0.65 which is adjusted for the capital structure of Motorola Corporation. Consequently, the equity beta of IESS is:

$$\beta_{E,IESS} = \left[1 + (1 - T) * \frac{B}{S} \right] * \beta_{unlevered,avg} = [1 + (1 - 0.34) * 0.42] * 0.65 = 0.83 \quad (29)$$

Comparing the derived equity beta of IESS which is 0.83 to the one of the Motorola Corporation as a whole which is 1.38 reveals that the automotive industry is considered to be less risky.

After having established an appropriate beta that reflects the risk of the IESS division the cost of capital can be derived using the WACC formula:

$$k_{s,IESS} = r_f + (E_{(rm)} - r_f)\beta_E = 4.89 + (12.7 - 4.89)0.83 = 11.4\% \quad (30)$$

$$WACC_{IESS} = k_b(1 - T)\frac{B}{V} + k_s\frac{S}{V} = 0.0671(1 - 0.34)0.295 + 0.114 * 0.705 = 9.3\% \quad (31)$$

For a detailed discussion of the formulas and their components see formula (1), (5) and (9) in chapter 3. The estimated divisional cost of capital for the IESS division is 9.3%. Consequently, it is unambiguous less than the corporate cost of capital. The reason is according to Collier and his colleagues (2007) that the automotive industry is known to be risk adverse and relatively conservative. They are typically awarded project contracts and do not have to speculate on new consumer products like in the wireless communication industry.

A similar analysis for each division would probably reveal that some segments use a higher and some a lower cost of capital than the overall corporate cost of capital which is appropriate for the average project. The example of Motorola Corporation shows that the pure-play method is relatively easy to apply in practice since the relevant data is accessible.

The next chapter deals with the handling of a special category of projects namely foreign investments. The estimation of risk-adjusted hurdle rates for investments made in a foreign country is discussed. The arising question, if the cost of capital should be higher or lower as the company cost of capital, is a controversy issue. The two opposite theoretical approaches, empirical evidence, the practical implementation and a firm-specific example is presented in the next chapter.

7 Foreign investment

Similarly as for several divisions the question arising for a multinational corporation is whether the required rate of return on foreign projects should be different from the overall required rate of return of the corporation. Specifically, the issue is whether the cost of capital for foreign projects should be higher, lower or equal as that for domestic projects (Shapiro 2005:380). In the following theoretical as well as empirical justifications for both approaches are presented.

7.1 Higher vs. lower cost of capital

In general there are two conflicting streams of research addressing the topic of cost of capital for foreign investments. Considering the foreign project as an individual investment it tends to be riskier than domestic projects because of several risk factors such as higher political risk, exchange risk, transfer payment risk or agency costs. In opposite, if the project is considered in the context of a portfolio, diversification benefits tend to balance the foreign country risk leading to lower hurdle rates. (Block 2003:354), (Kwok 2000:612)

7.1.1 Arguments for a decrease in the cost of capital

According to Shapiro (2006:491) additional economic and political risk faced by companies investing in foreign countries can be eliminated through diversification. Economic and political risk factors are considered to be unsystematic risk that is why even if they are quite large they should not affect an individual investor's required rate of return. Thus, the discount rate used to evaluate foreign project is not affected by the additional risk factors as economic or political risk. Shapiro (2007) argues that the high project risk faced by a foreign investment is offset by the low correlation between project and market returns. A project in a foreign country whose economy is likely to be not perfectly correlated with the home country's economy has a lower correlation coefficient than a domestic project which is likely to be more correlated with domestic market returns. Considering the beta formula (32), see also formula (5a), the less positive or more negative the correlation coefficient, thus the correlation between the foreign project and the market return, the lower is the systematic risk of the project.

Consequently, the systematic risk of a foreign investment can also be lower than the domestic one's, thus the discount rate used to evaluate the project has to be lower than that for a domestic project.

$$\beta_i = \frac{\rho_{im}\sigma_i}{\sigma_m} \text{ where} \quad (32)$$

σ_i = the standard deviation of the return on project i

σ_m = the standard deviation of the market return

ρ_{im} = the correlation between the return of project i and the market.

This is especially true for less-developed countries since their economies are less closely linked to the economy of for example the United States or the European Union. That means that in countries where political and economical risk might be at the highest level, as it is often the case in less-developed countries, a US or European investor can gain from diversification benefits. (Shapiro 2006:491pp)

7.1.2 Arguments for an increase in the cost of capital

Reeb and his colleagues (1998) found evidence of a significant positive relationship between the systematic risk of a firm and the degree of internationalization. This contradicts the theory that expanding internationally decreases the systematic risk due to diversification benefits. Reeb and his colleagues (1998) argue that internationalization causes exposure to additional economic risk factors leading to an increase in the variability of the firm, σ_i . Consequently, internationalization results in a potential increase of the systematic risk of the firm, if the increase in the variability of the firm is greater than the decrease in the correlation coefficient. Risk factors such as foreign exchange risk, political risk, agency problems and asymmetric information are given as explanation for the increase in the systematic risk caused by an increase in the variability. Going international means increased exposure to foreign exchange fluctuations which cause an increase in the variation of foreign returns in domestic currency. Political risk factors such as host government appropriation, differences in governmental and cultural practices and regulations, and fund remittance control may increase the risk of the company's cash flows. Further, as the ability to monitor managers and foreign operations decreases, the risk increases. Another potential problem refers to the availability of information. Local competitors might have a better access to information increasing the risk of making a poor investment. Reeb and his

colleagues (1998) conclude that the aforementioned reasons do not necessarily have to account for the observed increase in the systematic risk, but the arguments demonstrate that a decrease in the systematic risk because of diversification benefits cannot unambiguously be assumed when considering foreign investments hurdle rates. Furthermore, empirical results showed a significant positive relationship between internationalization and the systematic risk of a multinational corporation which is also consistent with the in several studies observed practice of using higher discount rates for foreign investments. Some of these research studies will be discussed in chapter 7.2.2.

7.1.3 An upstream-downstream hypothesis

Kwok and Reeb (2000) have extended the argument that foreign investments lead to higher risk exposure and developed a so-called upstream-downstream hypothesis. According to them, the internationalization effect on the systematic risk depends on the conditions of the home and target market. Specifically, risk increases for investments from stable economies but decreases for investments of firms based in less stable economies. Thus, the risk of foreign investments is influenced by the relative business risk among countries. Data from 32 countries from 1992 to 1996 taken from the WorldScope Database was used to examine the proposed hypothesis that risk for foreign investment of US firms, which are considered to be in a stable economy, is increasing, whereas the risk of foreign projects for firms based in emerging markets, which are considered to be less stable economies, is decreasing. Kwok and Reeb (2000) conclude that they accept the argument that diversification benefits impact on the systematic risk but according to them the most important factor that influences the overall effect of internationalization on firm risk is that different countries have different risk classes. Specifically, their empirical analysis suggests that foreign investments undertaken by US companies increase their systematic risk but the systematic risk of companies headquartered in emerging markets decreases with the degree of internationalization.

7.2 Empirical evidence

There are theoretical as well as empirical arguments for and against higher hurdle rates for foreign investments. In the following a study that supports the risk-reduction effect of international diversification is presented. Afterwards several empirical studies that observe the practice of managers when estimating hurdle rates for foreign investments are discussed.

7.2.1 Risk-reduction effect

The study of Fatemi (1984) does not support the argument that beta is increasing with the degree of internationalization. The findings suggest that multinational companies benefit from a risk-reduction effect due to international diversification. The risk-return opportunities for shareholders investing in multinational companies were observed comparing 84 multinational with 52 uninational companies on the basis of monthly returns and betas over a 60 month period. It was found that within the sample the rates of return of the group of multinational companies are more stable than those of uninational companies suggesting that diversification reduces the risk of shareholders. Further, the betas of internationally operating companies are significantly lower and fluctuate less than those of purely domestic firms suggesting that the degree of systematic risk of multinational companies is decreased by diversification. The effect of international involvement on beta was observed using a model of the following form which involves a regression of the degree of international involvement on the market beta after having removed the effect of the operating beta and financial leverage:

$$\beta^M - \left\{ \hat{a}_0 + \hat{a}_1 [\beta^0 / (1 - f)] + \hat{a}_2 f + \hat{a}_3 f \right\} = \delta_1 DII \quad \text{where} \quad (33)$$

β^M = market beta

β^0 = operating = $Cov(ROA_i, ROA_M) / \text{var}(ROA_M)$

f = financial leverage

DII = degree of international involvement measured as the % of total sales from international operations

The assumption that the level of international involvement influences beta could be proven right. It was found that beta decreases with a higher degree of international involvement. (Fatemi 1984:1328pp)

7.2.2 Estimation in practice

Several surveys have examined the estimation of hurdle rates in practice. Insights are gathered on how the risk of foreign projects is evaluated by managers and in which way the setting of hurdle rates is effected.

Managers responsible for capital budgeting are confronted with opposite arguments concerning the setting of cost of capital for foreign projects. Many textbooks rank foreign investments on the top of discount rate lists. Especially new products in foreign market are dedicated with the highest risk leading to an increase in the hurdle rate because of higher inherent risk. In opposite, considering the foreign investment in a portfolio context, it is suggested to use a lower hurdle rate because of diversification benefits.

In the survey of Block (2000:314) who examined if managers perceive foreign investment to increase or decrease risk exposure within 146 multinational companies, the clear majority believes that an increase in risk exposure occurs. Specifically 68.7% of respondents stated that risk increases whereas only 31.3% said that the risk exposure would decrease. Block argues that the reason for this could be the fact that not even half of the respondents do explicitly take into account interaction effects between projects.

The results obtained in the study of Block (2003) of 298 Fortune 1000 companies are similar if not even more unambiguous with 78% of respondents indicating that the discount rate for foreign investments should in general be higher and only 13% state that foreign investment projects should carry lower discount rates. Further, 9% had no opinion on the topic of risk assessment of foreign projects.

Consequently, in practice manager seem to support the theory that the risk exposure increases with international operations due to factors like political risk and economic risk. Thus, managers add a risk premium to the company cost of capital in order to compensate for the higher risk when estimating discount rates for foreign investments. The argument that foreign investments considered in a portfolio context can benefit from diversification does not seem to be widely accepted in practice (Block 2003:354p).

7.3 Estimating foreign investment hurdle rates

The problems that arise when estimating foreign investment hurdle rates are similar to the ones that occur when estimating divisional cost of capital. The lack of information that is needed to calculate beta is one of the main problems a manager or analyst has to face. Similarly as divisions in general, foreign subsidiaries or divisions or product lines responsible for foreign investments do not trade on the market. That is why there is no possibility to obtain market data that would be necessary to estimate betas directly. For a detailed discussion of the beta estimation see chapter 3.1.2.2.

7.3.1 The choice of a proxy beta

In his textbook Shapiro (2006:493pp) proposes a method to solve the problem in practice which could be interpreted as an extended pure-play approach. The method is more or less the same as the one suggested by Fuller and Kerr (1981) only that in an international context additional problems arise which will be discussed in the following. As well as for divisions a proposed solution in estimating the hurdle rate for foreign investments is finding publicly traded companies that have similar risk characteristics in order to calculate an average beta of the listed firms which can be used as a proxy for the beta of the foreign investment project.

The issues that Shapiro (2006) considers important in this context are the following. A decision to make is if the publicly traded companies, from which the proxy betas are taken, are located in the home country or in the foreign country where the investment is made. Additionally, one has to choose which relevant base portfolio should be considered, which market the risk premium should be based on and if the country risk should be incorporated in the cost of capital estimates.

To start with the choice of a proxy company it is recommended to use the beta of a local company if it is possible because the returns are likely to depend on the evolution of the local economy. Shapiro (2006) argues that from the perspective of an US investor, the use of US companies as proxies might result in upward biased estimates of the risk-premium since the systematic risk of comparable US companies might be higher than the risk of the foreign investment. To account for this bias the foreign market beta relative to the US index can be calculated using formula (35). The example of Singapore and Hong Kong is given where both markets have a standard deviation about twice as much as the US but their betas are unambiguously lower than the US

market beta of 1.0. The reason for having such low betas is, according to Shapiro (2006) that the risk of markets in individual countries is for the most part unsystematic and can be eliminated by diversification.

Another possibility is, if foreign proxy companies are not available, to find a proxy industry in the local market and use its beta to estimate the systematic risk of the foreign investment. This process refers to the pure-play industry beta method. If none of the two alternatives is accessible, an alternative option to estimate the foreign investment's beta would be calculating the U.S industry beta for the project and multiply it by the foreign market beta relative to the US index in order to get the so-called adjusted US industry beta.

$$\beta_{Adj.US.Industry} = \beta_{US.Industry.Proxy} * \beta_{Foreign.Market} \quad \text{where} \quad (34)$$

$$\beta_{Foreign.Market} = \frac{\rho_{US, fm} * \sigma_{fm}}{\sigma_{US}} \quad \text{with} \quad (35)$$

$\rho_{US, fm}$ = correlation with the US market

σ_{fm} = standard deviation of foreign market

σ_{US} = standard deviation of US market

The last approach is the least preferred because it contains two questionable assumptions. It is assumed that the beta for an US industry has the same relative beta in each market and that the correlation with the US market of an industry or segment is measured by the correlation of the local market with the US market. Thus, it is assumed that the industry correlates perfectly with the local market. Problems arise in the case when a firm or industry has a low correlation with the local market but a high correlation with the US market which might be true for companies like an oil firm. Shapiro (2006) states that the assumptions incorporated in the previously discussed approaches are no less reasonable than the assumption that foreign investments are inherently riskier than domestic ones. Another decision to make when estimating foreign investment hurdle rates is, as previously stated, the choice of the relevant base portfolio. The beta of a foreign project can be calculated relative to its home market or a global version of the CAPM can be used in which the beta refers to the project beta calculated relative to the global market portfolio. The global market portfolio refers to all securities that are actually available to an investor which should not be confused with the world portfolio that includes all securities in the world (Eiteman 2007:378). The importance of the relevant base portfolio will be discussed in the following. (Shapiro 2006)

7.3.2 The choice of the base market portfolio

The decision if a global or local base portfolio should be used depends on the judgment of the manager or analyst and about his/her view of capital markets. If capital markets are supposed to be globally integrated then the global market or world portfolio is the best choice. (Shapiro 2006:496)

The factors that cause segmented markets and prevent or slow global integration are regulatory controls, perceived political risk, foreign exchange rate risk, lack of transparency, asymmetric information, transaction costs, takeover defenses, small-country bias, cronyism, insider trading, tax differences, language, accounting principles and other market imperfections (Goldberg/Godwin 2001:18).

The use of the global market portfolio results in a global version of the CAPM:

$$k_s = r_f + [E_{rm,g} - r_f] \beta_{ig} \text{ where} \quad (36)$$

$E_{rm,g}$ = expected return on the global market portfolio

β_{ig} = project beta measured relative to the global market

The expected return on the global market portfolio is measured by the Financial Times World Index or the index of Morgan Stanley Capital International (MSCI). Despite the fact that capital markets are integrated heavily and are expected to become even more with time, Shapiro (2006) recommends US investors to measure the beta of foreign investments relative to the US market portfolio because it allows a comparison of foreign with domestic investments and the extent to which US investors actually hold an international diversified portfolio is relatively low. Further, the use of the US market risk premium for foreign investments is recommended, at least for US investors. The reasons are that the US capital markets provide the best data available on investors' required rate of return and as capital markets become increasingly integrated the market price of risk becomes the same globally. (Shapiro 2006:496pp)

To summarize, according to Shapiro (2006) the appropriate practical approach for estimating the cost of equity capital for foreign investments is to find a proxy company in the country in which the investment is made and estimate its beta relative to the US market. This proxy beta multiplied by the risk premium for the US market which is added to the home country risk-free rate is used to calculate the equity cost of capital for the foreign investment. An example of the impact of globalization on the cost of capital is given by the example of Nestlé in the following.

7.4 Firm-specific example

Stulz (1995) demonstrates the importance of the use of a global market portfolio rather than a local one for firms in small countries. The argument is manifested on the example of the situation of the company Nestlé in the year 1995. Since Nestlé made up a substantial part of the Swiss market capitalization the Swiss indices are highly correlated with the company. That is why the beta relative to the local market was nearly one. Considering the beta relative to the global market portfolio it was much smaller. Figure 20 shows the beta estimates for Nestlé relative to different indices; global and local ones. Comparing the Financial Times indices the beta calculated with respect to the local index is 0.885, whereas the beta calculated relative to a global market portfolio is only 0.585. Consequently, the use of the local beta results in overstating the risk of Nestlé. (Stulz: 1995:18p)

Indices	Beta estimate for Nestlé bearer shares	Beta estimate for FTA Switzerland	Beta estimate for MSCI Switzerland
FTA Switzerland	0.885	—	—
MSCI Switzerland	0.838	—	—
FTA World	0.585	0.737	0.788
MSCI World	0.595	0.756	0.809
FTA US	0.712	0.842	0.897
MSCI US	0.709	0.838	0.893

Figure 20: Beta estimates for Nestlé (Stulz: 1995:19)

The period from 1980-1990 is used to derive the components of the cost of equity. For that period the Swiss market portfolio reveals a value of 10.2%, the MSCI world market portfolio is 13.7% and the Swiss bond index yield is 3.3%. Calculating the required rate of return for an internationally diversified Swiss investor reveals an expected return of:

$$k_s^{Nestlé} = r_f + (E_{rm,g} - r_f)\beta_{ig} = 3.3 + (13.7 - 3.3)0.585 = 9.384\% \quad (37)$$

Conversely, using the local portfolio reveals a required rate of return for Swiss investors of:

$$k_s^{Nestlé} = r_f + (E_{rm} - r_f)\beta = 3.3 + (10.2 - 3.3)0.885 = 9.4065\% \quad (38)$$

Comparing the global and the local version of the required rate of return the results do not heavily differ. Nevertheless, since the values of beta and the market portfolios for the global and the local version reveal unambiguous differences, the potential for high

variances does exist. That is why it is important to analyze the investor's portfolio, risk perception and opportunity costs from an appropriate perspective. (Stulz 1995:20), (Eiteman 2007:377p)

8 Conclusion

The use of an appropriate hurdle rate is an essential part of the investment decision, but estimating correct cost of capital in practice is all but easy, nevertheless a necessary criterion in the process of maximizing shareholder value.

Even in theory there are a lot of differing opinions leading to various approaches underlying the topic of estimating appropriate hurdle rates. Practitioners are confronted with a vast amount of research in literature with partly conflicting theories. This is especially true for the evaluation of foreign investments where theoretical approaches go in opposite directions.

Despite other capital budgeting techniques like discounted cash flow methods are gaining significant acceptance in practice, where several studies report an unambiguous increase in the application among firms, this could not be found for divisional hurdle rates. The percentage of firms actually using divisional cost of capital is relatively low and a tendency of growth is not really noticeable. Specifically, considering the development from the year 1975 to 2003, much of change is not recognizable.

It seems that risk assessment in companies is of growing attention but the consideration of risk in the cost of capital estimation for projects with different risk-characteristics is not widely accepted. The reasons for this disregard might be the lack of a consensus about an existing method in practice and the enforcement of an easy practical handling for managers. If firms apply risk-adjusted hurdle rates, generally, they use the proposed method as a basis and adjusted the different approaches with firm-specific factors. Consequently, the methods offered in literature are not sufficient enough to support managers in the estimation of appropriate hurdle rates. The lack of conclusive empirical evidence might also be a reason that the methods have not become very popular.

The method by far most widely used is a subjective measurement of risk. According to the study of Block (2003) the clear majority, namely 65% of firms that do rely on divisional cost of capital base their risk assessment and accordingly their cost of capital estimation on managerial judgment. Consequently, the objective methods that are consistent with the theory are not enjoying great popularity. The method of the objective ones that is getting most attention in practice, even if its usage rates are relatively low compared to the subjective one, is the pure-play approach which uses the beta of competing firms as a proxy for the divisional beta.

A related topic is the estimation of hurdle rates for foreign projects. This topic evokes controversy, especially in theory, since two totally opposite approaches do exist. Practitioners seem to be in agreement that foreign investments should carry a higher hurdle rate since they are exposed to additional risk. A statement that is not accepted by all researchers since many of them are promoting the benefits of diversification in this context which lead to lower cost of capital.

Generally speaking, the topic of risk-adjusted hurdle rates is in a developing stage. A lot of research is still needed in future to be able to give practitioners a tool that helps them to evaluate projects with different risk characteristic in an efficient and understandable manner. Additionally, information about the benefits of risk-adjusted hurdle rates has to become more widespread in practice to encourage managers to pay more attention to the topic.

Abbreviations

WACC	Weighted Average Cost of Capital
CAPM	Capital Asset Pricing Model
IRR	Internal Rate of Return
NOPAT	Net operating profits after taxes
NPV	Net present value
CFO	Chief financial officer
R&D	Research and development
FTA	Financial Times index
MSCI	Morgan Stanley Capital International

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Appendix

Based on 1977 Sample			
	Unadjusted	Adjusted (Book Value)	Adjusted (Market Value)
β_j : Mean	1.031	—	—
Standard Deviation	0.333	—	—
Proxy Beta: Mean	1.045	1.108	1.200
Standard Deviation	0.294	0.388	0.529
Mean Difference, $\Delta(\beta)$	-0.015	-0.077	-0.169
Std. Dev. of $\Delta_j(\beta)$	0.105	0.233	0.453
Number of Positive $\Delta_j(\beta)$	11	8	7
Number of Negative $\Delta_j(\beta)$	12	15	16
Mean $AR\Delta(\beta)$	7.9%	17.1%	31.8%
Median $AR\Delta(\beta)$	5.3%	15.8%	16.6%
Regression r^2	.91	.64	.28

Appendix table 1: Leverage adjustment (Fuller/Kerr 1981:1005)

Appendix. Calculating the Risk Index

The risk index is the estimated cost of capital for various firms compared to Fuqua's cost of capital. To estimate the cost of capital for other firms, management makes the following assumptions:

1. The risk-free rate of interest is 12%.
2. The risk premium required by equity investors is 5%.
3. The firm's capital structure is 50% debt and 50% equity.
4. Their after-tax cost of debt is 7%.

Fuqua managers have studied competing firms in their lines of business and know, for example, that 1.9 is a reasonable estimate of beta for mobile home manufacturers. Using the CAPM and the assumption mentioned above, they calculate the cost of capital for a mobile home firm in the following manner:

$$k_e = R_f + b(k_m - R_f)$$

where

k_e = Cost of equity capital;

R_f = Risk-free rate;

b = Beta; and

$(k_m - R_f)$ = Risk premium required by investors.

Therefore,

$$k_e = .12 + 1.9(.05) = 0.215.$$

The cost of equity capital is considered the cost for a mobile home manufacturer with the same capital structure as Fuqua Industries.

As both the capital structure and after-tax cost of debt are assumed, the weighted after-tax cost of capital is:*

	Percent	Cost of Capital	Weighted Cost
Debt	0.50	0.07	0.035
Equity	0.50	0.215	0.108
	1.00		0.143 = 14.3%

The final step is to divide the cost of capital for the hypothetical mobile home firm (14.3%) by the cost of capital for Fuqua (12%) to give a Risk Index of 1.19.

The same process is followed for each line of business until the range of the risk index is established. As shown in Exhibit 3, it ranges from .90 to 1.20. Thus, these numbers represent the cost of capital for various types of firms relative to the cost of capital for Fuqua (assuming that the other firms have the same capital structure as Fuqua).

*The beta for Fuqua is 1.4. Using the same process described above, Fuqua's cost of capital is about 12% (12.6%).

Appendix table 2: Calculating the risk index (Gup/Norwood 1982:24)

Income tax rate, T_C	34%	
Risk free return, R_F	4.89%	30-year US Treasury Security, 23 January 2003 Source – Value Line
Market return, R_M	12.70%	
Beta	1.38	Source – Yahoo! Finance, 27 February 2003
MV of debt	7722	Million
MV of equity	18431	Million
Cost of debt, R_D	6.71%	
Cost of equity, R_E	15.67%	Calculated by CAPM: $R_E = R_F$ + $\beta * (R_M - R_F)$
Wt-debt, W_D	29.50%	= MV of debt / (MV of debt + market value of equity)
Wt-equity, W_E	70.50%	= MV of equity / (MV of debt + market value of equity)
WACC	12.30%	$WACC = W_D * R_D$ + $W_E * R_E$

Appendix table 3: Cost components of Motorola Corporation (Collier 2007:1229)

Abstract

Die Verwendung von angemessenen Kapitalkosten ist ein wichtiger Teil der Investitionsentscheidung. Jedoch ist die Bestimmung von Kapitalkosten sowohl in der Praxis als auch in der Literatur ein umstrittenes Thema. Diese Diplomarbeit behandelt die Schätzung von risikoangepassten beziehungsweise abteilungsspezifischen Kapitalkosten. Im Speziellen wird die Ermittlung der Kapitalkostensätze für Abteilungen, Produktgruppen oder auch für ausländische Investitionen diskutiert. Dabei soll vor allem die praktische Anwendung der in der Fachliteratur vorgeschlagenen theoretischen Modelle untersucht werden. Hierbei beschränkt sich die Arbeit auf drei Methoden, nämlich die Pure-Play Methode, die Accounting Beta Methode und eine subjektive Methode. Folglich wird dann ein sogenannter Theory-Practice Gap im Bereich der risikoangepassten und vor allem abteilungsspezifischen Kapitalkostensätze diskutiert.

Zahlreiche Studien haben einen eindeutigen Anstieg der Verwendung von theoretischen Modellen in der Praxis aufgezeigt. Beispielsweise ist die Kapitalwertmethode ein weitverbreitetes Instrument. Übereinstimmung von Theorie und Praxis kann aber im Bereich der risikoangepassten beziehungsweise abteilungsspezifischen Kapitalkostenermittlung nicht gefunden werden. Bei der Bestimmung von Kapitalkosten und im Speziellen bei der Kalkulation von abteilungsspezifischen Kapitalkostensätzen kann keine deutliche Steigerung bei der Anwendung in der Praxis gefunden werden obwohl die Verwendung eines einheitlichen firmenweiten Kapitalkostensatzes zu falschen Investitionsentscheidungen führen kann und dadurch eine optimale Kapitalverteilung innerhalb des Unternehmens nicht gewährleistet ist. Trotz der steigenden Aufmerksamkeit für Risikoermittlung in der Praxis ist der Prozentsatz der Unternehmen die diese Risikokalkulationen in ihre Kapitalkostenberechnung einfließen lassen relativ gering.

Im ersten Teil beschäftigt sich die Arbeit vor allem mit den theoretischen Ansätzen, wobei mit der allgemeinen Kapitalkostenermittlung begonnen wird, da diese die Grundlage der risikoangepassten Methoden darstellt. Der Fokus liegt dabei in der Berechnung des systematischen Risikos, da dies der Ausgangspunkt bei der Ermittlung von abteilungsspezifischen Sätzen ist. Im zweiten Teil der Arbeit werden verschiedene Studien diskutiert die die Anwendung dieser Methoden in der Praxis untersucht haben. Weiters werden einige firmenspezifische Beispiele präsentiert um

einen genauen Einblick in die tatsächliche Bestimmung in der Praxis zu bekommen. Weiters wird die Schätzung von Kapitalkosten für Auslandsinvestitionen diskutiert.

Abschließend kann festgestellt werden, dass dem Thema der abteilungsspezifischen Kapitalkosten in der Praxis geringe Aufmerksamkeit geschenkt wird, da der Anteil der Unternehmen die risikoangepasste Kapitalkostensätze verwenden sehr gering ist, obwohl bei Verwendung eines einzigen firmenweiten Kapitalkostensatzes eine effiziente unternehmensinterne Kapitalallokation nicht sicher gestellt ist.

Curriculum vitae

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