MSc Program
Engineering Management

Company valuation methods and their practical relevance

A Master's Thesis submitted for the degree of
"Master of Science"

supervised by
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Vienna, 31.03.2016

Affidavit

I, **GEORG WEITL**, hereby declare

1. that I am the sole author of the present Master's Thesis, "COMPANY VALUATION METHODS AND THEIR PRACTICAL RELEVANCE", 89 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

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Abstract

The topic company valuation is one of the most significant areas of business administration but also one of the most controversial. In the literature there can be found a broad spectrum of methods and concepts for the valuation of companies with a difference in the complexity of its application. The aim of this master thesis is to give an overview of the topic company valuation and the existing valuation methods and to provide a better understanding, which methods are actually used in practice and what are the details that have to be considered. The methods of company valuation can be classified in three basic groups depending if they are focusing only on the values of the single components of the company, the company as one unit that is a compositions of its assets, or on something in between. The most common method used internationally and also the most practical relevance has the discounted cash flow method (DCF) with its three approaches. But typically not only one method is used but a combination of the DCF method and the multiple-based approach to validate the results is applied. Under the discounted cash flow method there exist three approaches, the WACC- (weighted average cost of capital), the APV- (adjusted present value), and the FtE- (flow to equity) approach. The individual variants of the DCF-method distinguish themselves basically in the manner of calculating the shareholder value directly (equity approach) or indirectly (entity approach), and how the tax advantage due to debt financing (tax shield) is used. The aim of all approaches is to determine the market value of the company respectively its equity and therefore estimating the present value of a company by discounting its future payments, the free cash flows (FCF). The estimation and forecasting of the free cash flows is done based on an analysis of the valuation object, it's historical performance, and the market environment. In order to perform the calculation of the discounted cash flows it is necessary to determine the costs of equity based on the capital asset pricing model and the costs of debt. The multiple-based approaches are using the known market prices of other companies to calculate multiples that are then taken to valuate the object company. There is the possibility to either taking the market price of stock exchange listed companies or using the market price of recently acquired comparable companies. For the selection of comparable companies or transactions it is important that they share the same characteristics as the valuation object.

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List of abbreviations

APV	Adjusted present value
b	Earnings retention rate
β	Beta factor of a security (i.e. it's sensitivity to the market)
β_D	Debt beta
β_L	Levered beta
β_U	Unlevered beta
CAPM	Capital asset pricing model
CV	Company value
CV_E	Market value of equity (company value)
CV_L	Market value of total company (incl. debt)
CV_U	Market value of unlevered company
D	Debt of a company (at market value)
D/E	Debt/Equity ratio
DCF	Discounted cash flow
E	Equity of a company (at market value)
EBIT	Earnings before interest and taxes
EBITA	Earnings before interest, taxes, and amortization
EBT	Earning before taxes
EP	Earning power
EV	Enterprise value (synonym of CV_L)
$E(r_j)$	Expected return of a security
$E(r_m)$	Expected return of the market portfolio
FCF	Free cash flow
FtE	Flow to equity
g	Growth rate
GICS	Global Industry Classification Standard
IFRS	International Financial Reporting Standards
i_r	Risk-free interest rate
IC	Interest cost
k	Interest rate
k_D	Cost of debt

k_E	Cost of equity
k_{E-L}	Levered cost of equity (of company with debt; debt-financed)
k_{E-U}	Unlevered cost of equity (of company without debt; pure self-financed)
k_{WACC}	Weighted average costs of capital
mrp	Market risk premium
NAV	Net asset value
NPV	Net present value
NOPLAT	Net operating profit less adjusted taxes
PV	Present value
ROA	Return on Assets
ROE	Return on equity
ROIC	Return on invested capital
SIC	Standard Industrial Classification
t	Time-index
T	Planning horizon
T_m	Corporate tax rate
TC	Total capital of a company
TCF	Total cash flow
TV	Terminal value
WACC	Weighted average cost of capital
w/o	without

1 Introduction

1.1 Problem definition

The topic company valuation is one of the most significant areas of business administration but also one of the most controversial. Numerous books and articles on this topic with partly contradictory views confirm this situation (Ballwieser, 2011; Mandl & Rabel, 1997).

There are several reasons why the subject of company valuation is facing high attention in both science and practice. On the one hand the number of company transactions as well as the extent of the transaction volumes has been increasing constantly within the last decades. And for each company transaction usually also a valuation is needed (Kuhner & Maltry, 2006). On the other hand also the discussion about value-based management has given a strong impulse to the field of company valuation. As the management theory and practice based on the shareholder value needs a market-oriented valuation method to measure the impact of the corporate policy on the value of the ownership shares (Drukarczyk & Schüler, 2009).

In the literature there can be found a broad spectrum of methods and concepts for the valuation of companies with a difference in the complexity of their application. Especially the influences of the Anglo-American area with the value-based-management-approach and the market oriented discounted cash flow method have brought a counterpart to the earnings valuation approach that was predominant until then in the valuation theory in the German-speaking area (Schacht & Fackler, 2009). In particular the discounted cash flow method has high popularity with people usually involved in this topic in practice such as investment banker, management consultants, and other specialists for mergers and acquisitions (Koller, Goedhart, & Wessels, 2005; Rosenbaum & Pearl, 2009).

It seems to be helpful also for an engineering manager to have a reference guide that can be referred to if he is affected by the topic. Therefore, the aim of this master thesis is to give an overview of the topic company valuation and the existing valuation

methods and to provide a better understanding, which methods are actually used in practice and what are the details that have to be considered.

1.2 Research issue

Bases of the mentioned problem definition the following research questions can be formulated:

1. *Which valuation methods have the most practical relevance in the economy?*

2. *How are these methods applied in detail?*

The main focus of this thesis should be to answer both research questions.

1.3 Way of argumentation

In the second chapter the various occasions and purposes for the valuation of a company are described.

Chapter three starts with an overview of the spectrum of existing valuation methods and provides a classification of the main categories that are the single valuation approaches, the mixed valuation approaches, and the total valuation approaches. The first category can be divided into the calculation of the net asset value based on either the reproduction value or the liquidation value. The second category includes the mean value method and the excess profit method. In the third category are the income approaches and the market approaches that will be discuss also in detail in the following chapters.

In chapter four the theory of the discounted cash flow method is presented and the three models, the weighted average costs of capital, the adjusted present value, and the flow to equity are described in detail including examples to show how the models are applied. Then the capital asset pricing model for the calculation of the costs of equity is presented. After that, the valuation based on multiples is described.

In chapter five the relevant aspects for a valuation in practice are discussed. This includes the analysis of historical performance, forecasting of performance, and the estimation of the terminal value. Then the determination of the equity costs using the CAPM and the estimation of further parameters is discussed.

The last chapter includes the answer of the research questions and the summary of the most important results of this thesis.

2 Occasions and purposes of company valuation

2.1 Occasions of company valuation

The valuation of a company can happen due to various occasions and the following breakdown categorizes the different reasons in the ideal-typical lifetime cycle of a company (Drukarczyk & Schüler, 2009; Kranebitter, 2007):

Foundation

- Valuation by the founder
- Valuation by investors (e.g. business angle, venture capital)
- Organization of new rounds of financing

Running valuation occasions

- Value-based management
- Accounting under IFRS (International Financial Reporting Standards)
  - Impairment test
  - Purchase price allocation
- Change of the shareholder structure (e.g. squeeze-out of minorities)
- Tax purposes

Expansion

- Valuation of growth options
- Pricing of new shares (IPO, capital increase)
- Mergers and acquisitions

Restructuring

- Divestments, spin-offs, and demergers
- Valuation of liquidation options
- Valuation in the course of financial restructuring

2.2 Purposes of company valuation

The value of a company (valuation object) cannot be determined detached from the purpose of its valuation, as there is not one right value of a company. Therefore, the valuation procedure has to be aligned with the occasion and the purpose of the valuation. Occasions of company valuation, as described before, can typically be summarized to purposes of valuation and in business administration practice it can be differentiated between the following three types (Bertl, Mandl, & Aschauer, 2010).

Decision value (subjective company value)

The decision value is based on the individual subjective expectations and perceptions as well as other circumstances of the decision maker (valuation subject). The decision value is therefore also called subjective company value. It is that value where the valuation subject is indifferent between at least two alternatives. For a potential buyer or seller this value would be the price ceiling respectively the bottom price (so-called marginal price) were the economical situation of the buyer or seller wouldn't change in case of a purchase or sale (Aschauer & Purtscher, 2011).

Arbitration value

The arbitration value has to be determined in a conflict situation under consideration of both parties' opinions solely under objective aspects. The investment alternatives as well as the personal circumstances of the valuation subjects are taken into account to define a fair and appropriate reconciliation of interests (Moxter, 1983).

Objective company value

The objective value represents that company value that is calculated by a discounting procedure under the assumption of continuation of the business on basis of the existing corporate concept and all realistic future expectations of market chances and risks as well as financial possibilities. It is the central part of the Austrian expert opinion KFS/BW1 and the German valuation standards IDW S1 that represents the expected value detached from any subjective or individual assumptions (KFS/BW1, 2014; IDW S1, 2008).

3 Overview and systematical classification of valuation methods

3.1 Overview

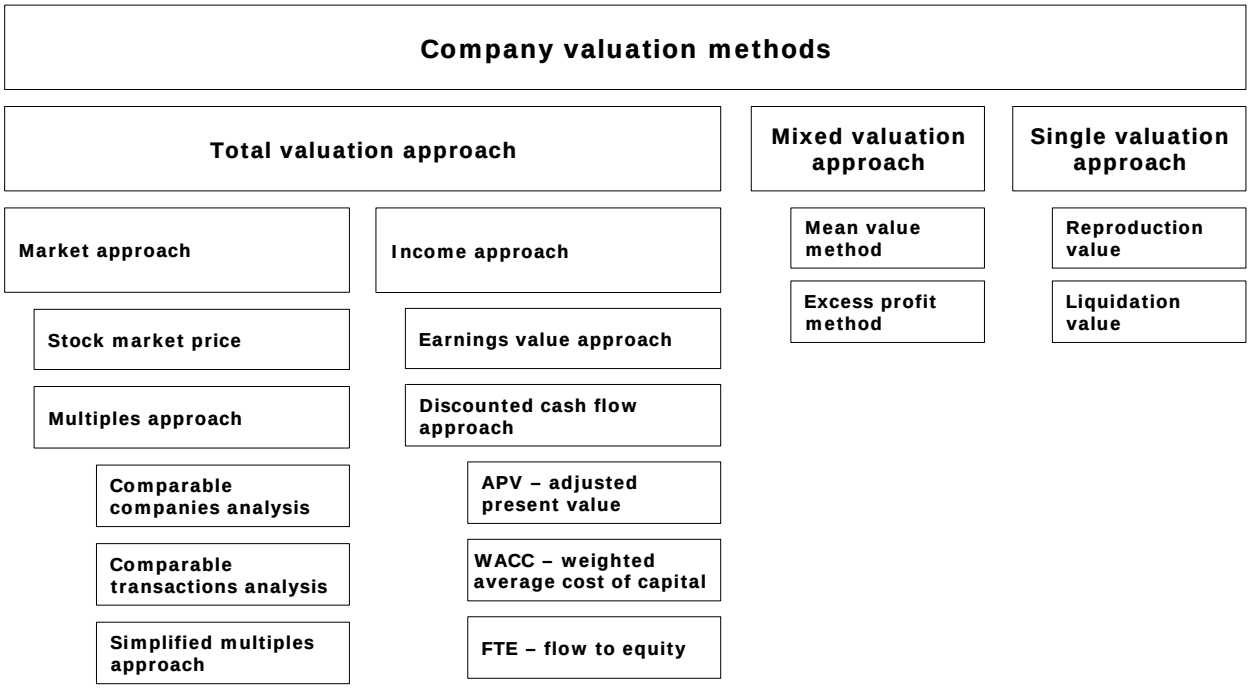

Figure 3.1: Company valuation methods (adapted from Aschauer & Purtscher, 2011; Ernst et al., 2010)

The methods of company valuations can be classified in three basic groups depending if they are focusing on the company as a unit by itself (total valuation approach), the sum of its single components (single valuation approach), or are in between this first two approaches (mixed approach) (Ernst, Schneider, & Thielen, 2010). Figure 3.1 shows the assignment of the existing methods for company valuation to one of the three groups. Hereinafter will be a short introduction of the various methods and after that will follow an in detail description of the most important methods.

3.2 Single valuation approach

The single valuation methods have an asset-based approach were the net asset value of a company is calculated. The net asset value is the sum of the values of single assets minus the value of liabilities at a certain cutoff date:

	Value of single assets	
-	Value of liabilities	(1)
=	Net asset value	

Due to the isolated valuation of the single assets there is no consideration of the combined effects of the assets, and therefore this is seen as a disadvantage of this method. The net asset value can be calculated under the assumption of continuation (reproduction value) or the liquidation (liquidation value) of the company (Mandl & Rabel, 1997).

3.2.1 Net asset value on basis of reproduction values

The basis of this method is the idea that instead of buying an existing company a new company equivalent to the object of purchase will be replicated and the costs for that are taken as valuation. The problem of this approach is that a complete replication would be normally not succeeding because certain intangible assets (brand, know-how, or customer relationships) must be valuated as well, which is often difficult and sometimes impossible. Therefore only the replacement prices of the company's assets (partial reproduction value) can be indicated, but such a replication does not comply with the company value (Heesen, 2014).

3.2.2 Net asset value on basis of liquidation values

The asset valuation on basis of liquidation values is made under the assumption of dissolution of the company. The liquidation value is the result of the sale of the single assets minus liabilities and costs for liquidation. A disadvantage of single valuation methods is that entrepreneurial acts, achievement of future revenues due to the interaction of the single assets, are unconsidered. Nonetheless, these methods are used

in practice for the valuation of companies with faint profitability or in the event of insolvencies (Ernst et al., 2010). In case the net present value (NPV) of the financial surplus that are yield through the liquidation of a company is higher than the going concern value of the company, than the liquidation value is representing the lower limit of the company value (KFS/BW1, 2014).

3.3 Mixed valuation approach

Mixed valuation approaches can be considered as advancement of single valuation approaches and include beside the net asset value also the earning power of a company. The company value is determined either via the mean value method or the excess profit method (Kuhner & Maltry, 2006).

3.3.1 Mean value method

The simplest case is the calculation of the company value (CV) based on the arithmetic mean of the net asset value (NAV) based on reproduction value and the earning power (EP) determined on basis of the period's profit (Heesen, 2014):

$$CV = \frac{NAV + EP}{2} \tag{2}$$

Further variants are possible with the application of different weighting factors for the net asset value or the earning power (Kuhner & Maltry, 2006).

3.3.2 Excess profit method

The company value is calculated as a sum of the net asset value (partial reproduction value) and the net present value of the excess profit (goodwill).

	Net asset value (partial reproduction value)
+	Net present value of excess profits (goodwill)
=	Company value (CV)

(3)

The added value of the total company compared to the net asset value is described as goodwill. This goodwill is dependent on future earnings, capitalization interest rate, and the sustainability of the excess profits. The excess profit method has no significance in the company valuation practice (Ernst et al., 2010).

3.4 Total valuation approaches

The third group of valuation methods is the so-called total valuation approaches that consider a company as a valuation object in total and not as a sum of its single assets, as the previous mentioned approaches. Total valuation approaches can be divided in two categories, on the one hand the income approaches determine the value by calculating the net present value of future cash flows generated by the business, and on the other hand the market approaches determine the value by comparing the object company to the market price of other companies (Heesen, 2014).

3.4.1 Income approaches

The group of income approaches can be divided into the discounted cash flow (DCF) approach and the earnings value method. Both methods are based on the net present value method, i.e. evaluate the future cash flow of a company at a specific date, and are therefore not distinguishing themselves in sense of the method. The difference of the two approaches is that the earnings value method is calculating the decision value and the DCF-method is determining the market value, meaning using more restrictive assumptions based on finance theory models (Aschauer & Purtscher, 2011).

Under identical assumptions about the financial surpluses and the requirements on return of equity the earnings value method conforms the equity approach of the DCF method (KFS/BW1, 2014). In practice a strong convergence between the earnings value method and the DCF-method can be noticed. For that reason and also due to the stronger influence of Anglo-American valuation methods only the discounted cash flow approach has a practical relevance (Ernst et al., 2010). Therefore only the DCF-method will be considered in more detail for the income approach in this thesis.

The company value in accordance with the DCF-method is equivalent to the net present value of future cash flows discounted at a certain discount rate. The difference of the individual approaches is the particular manner of the cash flows relevant for the valuation, the interest rate to be applied, and the tax shield due to debt financing. The following three methods have relevance in practice and are discussed in more detail later in this thesis (Jäger, 2013):

- WACC – weighted average cost of capital
- APV – adjusted present value
- FTE – flow to equity

3.4.2 Market approach

In comparison to the income approach there is no comprehensive analysis of future cash flows, instead the value of a company is calculated directly via its market price (if stock exchange listed) or indirect via comparison procedures (Rosenbaum & Pearl, 2009). A valuation based on multiples cannot replace a DCF-analysis but when properly executed it can help to test the plausibility of the cash flow forecast and has a role as complement valuation technique. Empirical research also shows that valuations based on useful information from both approaches and the usage of them in combination is likely to produce more accurate estimations of the value of a company than the use of each method isolated (Arzac, 2008).

When using multiples for valuation the comparison procedures can be classified in three methods. The first two are deriving the market value of a company by taking the known market price of other companies for the calculation of the multiple. One possibility is the market price of stock exchange listed companies, the use of these trading-multiples is known as “comparable companies analysis”. The other possibility is the “comparable transaction analysis”, which is using transaction-multiples that are based on the market price of recently acquired comparable companies (Kranebitter, 2007). The most important point when using these methods is the selection of appropriate comparable companies with similar prospects, the application of multiples based on forward looking estimations, and the adjustment of enterprise-value multiples for non-operating items (Koller et al., 2005).

The third technique in the group of market approach methods is the simplified multiples method were an estimated market price is calculated based on experience values, so called market multiples. These multiples are commonly used for the valuation of smaller companies and are based on industry-specific knowledge and can be seen as a “rule of thumb” (Ernst et al., 2010).

3.5 Conclusion

Summarizing the methods described before there is theoretically a huge variety of valuation techniques existing with different relevance in practice. The most common method used internationally is the discounted cash flow approach. But typically not only one method is used but a combination of the DCF method and the multiple-based approach to validate the results is applied (DVFA, 2012).

According to the expert opinion of the “Austrian Chamber of Public Accountants and Tax Advisers for the Valuation of Businesses”, the future profit value of a business can be determined either with using the earnings value approach or the discounted cash flow method and additionally the plausibility has to be assessed by using a multiples method (KFS/BW1, 2014). Based on this account the following discussion of company valuation methods will focus on the DCF-method and the multiples methods.

4 Valuation theory and concepts

4.1 Discounted cash flow methods

4.1.1 Overview of DCF-methods

All procedures of measuring the corporate value of a company based on the DCF-method have in common that they are estimating the present value (PV) of a company by discounting future payments. The theoretical background for this method is the capital market theory of Modigliani and Miller (Jäger, 2013). The individual variants of the DCF-method distinguish themselves basically in the manner of calculating the shareholder value directly (equity approach) or indirectly (entity approach), and how the tax advantage due to debt financing (tax shield) is used (Spremann & Ernst, 2011). The DCF-method can be split up into four approaches, as shown in figure 4.1.

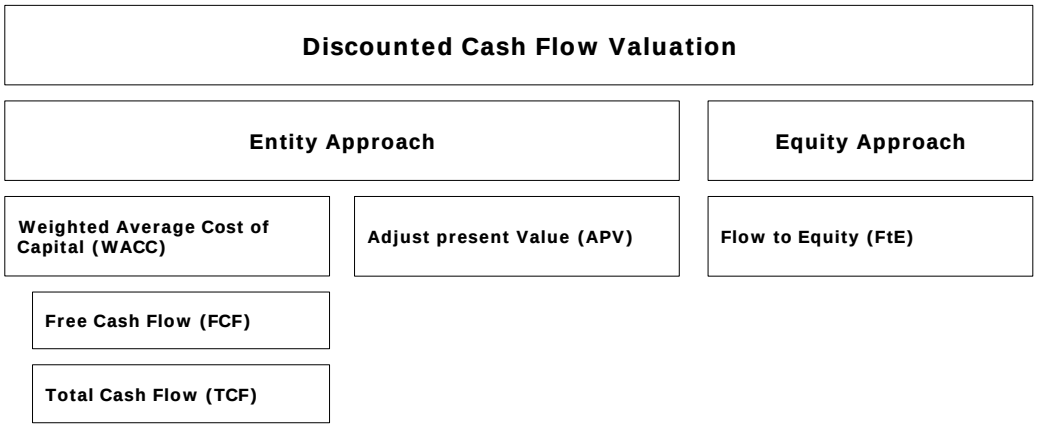

Figure 4.1: DCF-methods (adapted from Jäger, 2013, Mandl & Rabel, 1997)

The aim of all approaches is to determine the market value of the company respectively its equity. The entity approach is calculating the shareholder value in a two-step approach. First calculating the value of the whole company and secondly reducing it by the fair value of debt capital to define the shareholder value. In comparison the equity approach is estimating the value of the company directly based on the cash flow to equity discounted by the cost of capital (Ballwieser, 2011). In case the company's capital structure is expected to change significantly (autonomous financing policy), it is

recommended to use the adjusted present value, as the APV values the cash flow associated with capital structure separately from the cost of capital (Koller et al., 2005).

4.1.2 Theoretical background

a. Influence of the capital structure on the company value

Starting point of the discounted cash flow approaches is the question if the capital structure (debt (D) to equity (E)) has an influence on the value of a company? The first proposition of Modigliani and Miller (1958) states that in an economist's ideal world the total value of a company (CV) is independent of the company's capital structure. The second proposition of Modigliani and Miller (1963) states that a company's cost of equity (k_E) is a positive linear function to the company's capital structure (Ross, Westerfield, & Bradford, 2003). The weighted average costs of capital can be expressed in (4):

$$WACC = k_E * \frac{E}{CV} + k_D * \frac{D}{CV} \quad (4)$$

This means that the required return on equity for a debt-financed company ($k_{E\text{-}L}$) is increasing linear with the increase of debt. The cost of debt (k_D) is equivalent with the risk free interest rate. The rate of return composes of the cost of equity for a pure-self financed company and a risk premium ($k_{E\text{-}U}$–k_D) for the higher investment risk depending on the debt ratio (D/E). This connection can be expressed in (5) (Aschauer & Purtscher, 2011) and in figure 4.2:

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * \frac{D}{E} \quad (5)$$

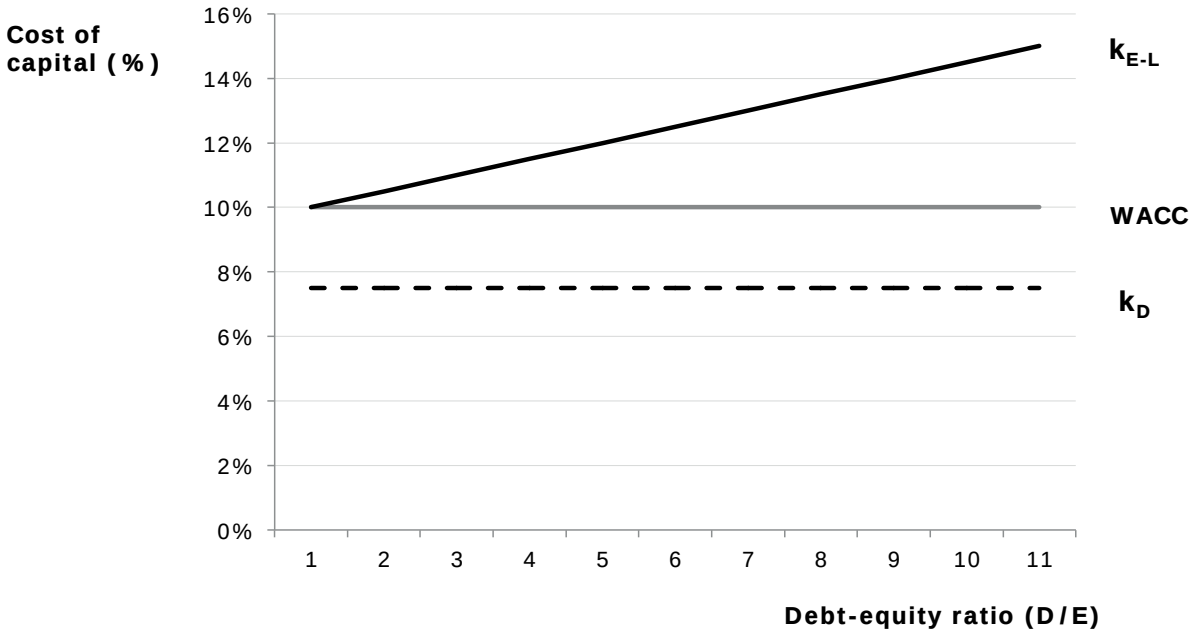

Figure 4.2: Cost of equity and debt ratio (adapted from Ross et al., 2003)

The fact that payments made for interest are deductible for tax purposes leads to the situation that there is a tax advantage of debt capital against equity. This value advantage of debt capital is equal to interest cost (D x k_D) multiplied by the corporate tax rate (T_m). This tax savings are called tax shield (Ross et. al., 2003). This circumstance can also be seen in the adapted formula (6) for the costs of capital and the rate for return in equity (7) (Aschauer & Purtscher, 2011):

$$WACC = k_{E-L} * \frac{E}{CV} + k_D * (1 - T_m) * \frac{D}{CV} \quad (6)$$

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * (1 - T_m) \frac{D}{E} \quad (7)$$

In figure 4.3 can be seen that the required return on equity is growing slower by (1-T_m) and how the WACC declines as the debt-equity ratio grows. This illustrates again that the more debt the firm uses, the lower is its WACC (Ross et. al., 2003).

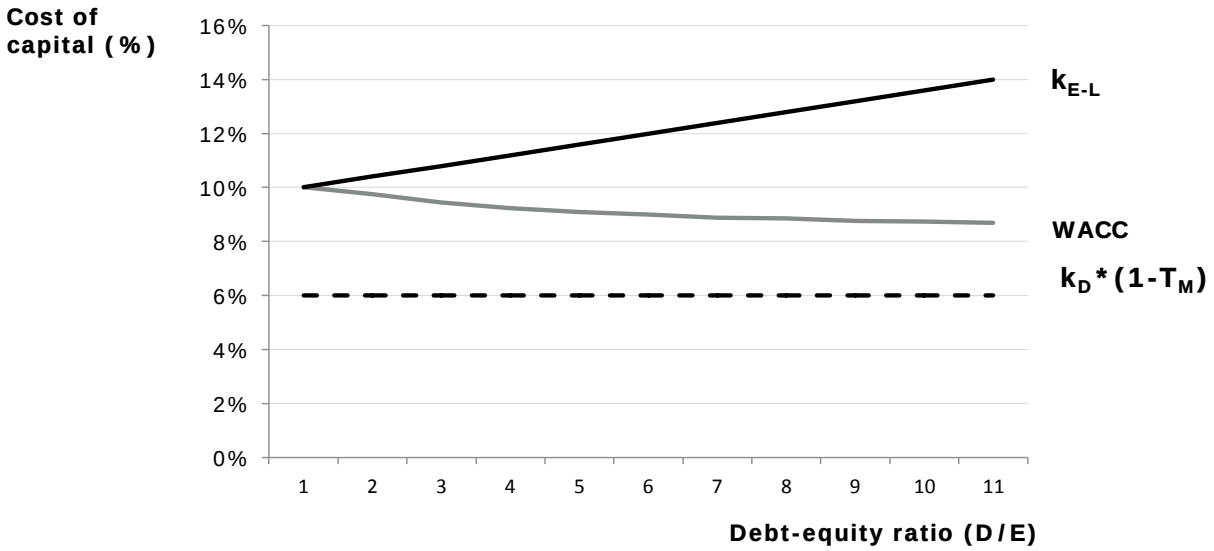

Figure 4.3: Cost of equity and debt ratio with tax (adapted from Ross et al., 2003)

The market value of a debt-financed company is therefore higher by the amount of the tax shield compared with a pure equity financed company and the market value of the company is increasing with the increase of the debt financing. Theoretically, the optimum would be with 100% debt financed, but this cannot be applied in practice (Ross et al., 2003).

Although academic researchers have investigated the issue for decades, there is still no clear model for a company's optimal capital structure that would create most value for shareholders. But for practical application there has been an approach developed for designing and managing the capital structure to achieve an effective capital structure (Koller et al., 2005).

In conclusion, it is necessary to plan the proportion of debt accordingly and this information is also relevant for the valuation of the company. Depending on the financing policy used within a company a different valuation method has to be used (Jäger, 2013).

b. Financing policy

In determining its financing policy a company can follow two different strategies. The first is the autonomous financing policy, where the amount of debt capital is independent of any other factor and will be determined for each future period (Drukarczyk & Schüler, 2009). The second is the value-based financing policy, where a target debt-to-value ratio is determined and the proportion of debt capital is therefore increasing/decreasing alongside with the company value (Mandl & Rabel, 1997). Depending on the financing strategy of a company one DCF-method is recommended, as it can be seen in figure 4.4.

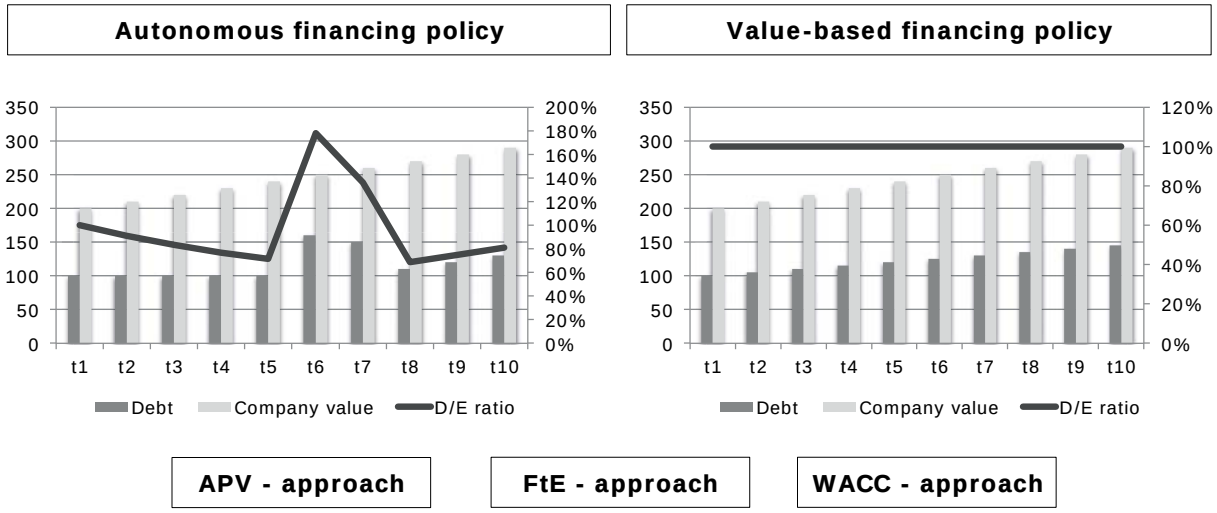

Figure 4.4: DCF-methods and financing policies (adapted from Aschauer & Purtscher, 2011)

c. Continuing / terminal value

The capital market theory requires that all theoretical future cash flows until the end of an investment are considered. Therefore it is necessary to define the future free cash flows of a company for an uncertain period of time (Rosenbaum & Pearl, 2009). As it becomes very difficult to project every financial statement line item for more then just a few years, the calculation of the present value of a company is split accordingly (Koller et al., 2005):

Value of operations = Present value of free cash flow during explicit forecast period + Present value of free cash flow after explicit forecast period

The final year of this explicit forecast period is labeled the terminal year and the terminal value (TV) is then the present value of free cash flows occurring beyond the terminal year (Palepu, Healy, & Peek, 2013). In the practice of valuation of investments with an uncertain period of time it has prevailed that after a detailed planning period a sustainable surplus is assumed. This surplus is set as present value of a perpetual annuity, and called continuing value or terminal value. The present value of a perpetuity of C is calculated in (8) (Ross et al., 2003).

$$PV = \frac{C}{k} \tag{8}$$

4.1.3 Weighted Average Cost of Capital model (FCF)

The WACC-approach is calculating the company value by discounting the free cash flow with the weighted average costs of capital (k_{WACC}) and afterwards subtracting the market value of debt, as shown in figure 4.5 (Kruschwitz, Löffler, & Essler, 2009).

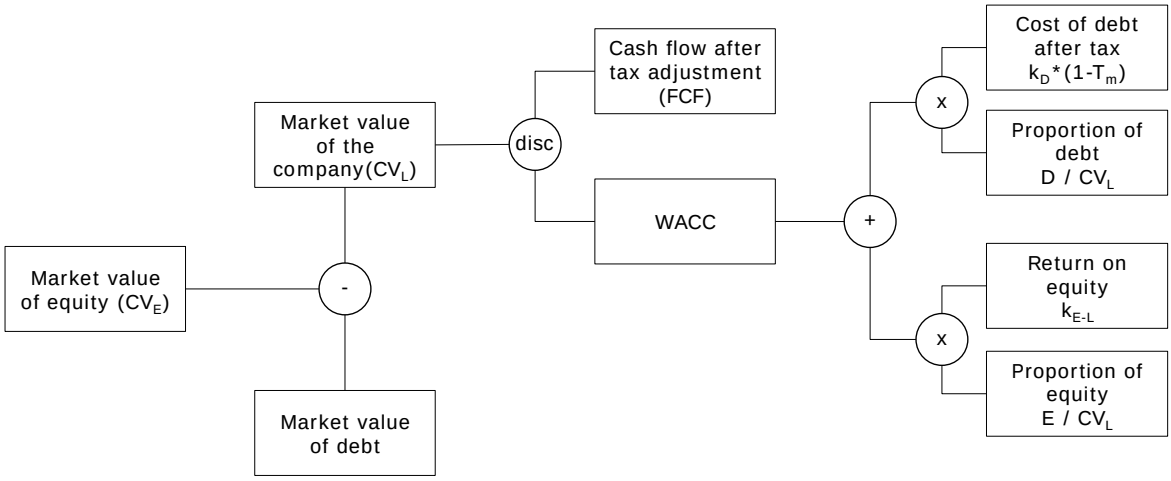

Figure 4.5: WACC-approach (adapted from Drukarczyk & Schüler, 2009)

The calculation of the free cash flow (FCF) is based on the assumption of a company financed entirely with equity. This has the advantage that the operating performance of a company can be compared without regard to the capital structure (Koller et al., 2005). The FCF derives therefore only from the key performance areas of the company

and is not influenced due to its financing activities or payments to outside creditors and can be calculated in the following way (KFS/BW1, 2014):

	Earnings before interest an taxes (EBIT)
-	Taxes for pure self-financing
=	Net operation profit less adjusted taxes (NOPLAT)
+/-	Expenses/income from asset disposal
+/-	Depreciation/appreciation
+/-	Creation/release of long term provisions and other cash expenses/income
-/+	Increase/decrease of net working capital (w/o current interest bearing liabilities)
-/+	Cash flow from investments/divestitures
=	**Free Cash Flow (FCF)**

The computed FCFs are discounted with the weighted average costs of capital to calculate the company value as represented in (9) (Kuhner & Maltry, 2009):

$$CV_L = \sum_{t=1}^{T} \frac{FCF_t}{(1 + k_{WACC})^t} + \frac{FCF_{T+1}}{k_{WACC} * (1 + k_{WACC})^T} \quad (9)$$

The weighted average costs of capital (k_{WACC}) comprise the required rates of return for debt (k_D) and the return for equity of a debt financed company ($k_{E\text{-}L}$) based on their market values, and is defined in the following formula (Spremann & Ernst, 2011):

$$k_{WACC} = k_{E-L} * \frac{E}{CV_L} + k_D * (1 - T_m) * \frac{D}{CV_L} \quad (10)$$

The cost of debt is reduced by the marginal tax rate (T_m) as the interest tax shield has been excluded from the calculation of free cash flow (interest is tax deductible) (Koller et al., 2005). It can be recognized that there is a circularity problem as for the calculation of the market value for equity (E/CV_L) and debt (D/CV_L) the market value of the leveraged company itself has to be known. This problem can be solved by mathematical iteration or by a value-based financing policy that implies a constant debt-to-equity ratio, and therefore the proportion of debt is known. Differences between

target capital structure and actual capital structure would lead to a distortion of the results (Kruschwitz & Löffler, 2006).

Furthermore, the result is interdependent with the required rate of return for equity for a debt-financed company (Aschauer & Purtscher, 2011):

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * (1 - T_m) \frac{D}{E} \quad (11)$$

For the value-based financing policy it has to be considered that due to the interconnection of debt-financing and total company value the amount of debt-capital and therefore the interest payments are uncertain as well as the tax shield as the total company value is also uncertain. As uncertain tax shields have less value then certain ones, the value-based financing policy has an impairing effect on the value of the company (Drukarczyk & Schüler, 2009). This circumstance has been considered in the adapted formula of Harris and Pringle (1985) (12):

$$k_{WACC} = k_{E-U} - T_m * k_D * \frac{D}{CV_L} \quad (12)$$

As a last step it is necessary to calculate the market value of equity that is then the company value (Heesen, 2014):

	Present value of free cash flows at capitalization with k_{WACC}
+	Market value of non-operation capital
=	Market value of company (incl. debt) (CV_L)
-	Market value of debt at t_0
=	**Market value of equity (company value) (CV_E)**

The procedure of the WACC-approach is based on the work of Modigliani and Miller and known for its ease of application and therefore the most widely used approach in practice (Aschauer & Purtscher, 2011).

Example 1: WACC-approach (adapted from Aschauer & Purtscher, 2011)

The budgeting for Example-GmbH with a three-year planning horizon looks as the following and a free cash flow can be derived (simplified statement):

Free cash flow calculation	20X1	20X2	20X3	from 20X4*
Net sales	1.000,00	1.100,00	1.210,00	
- Production costs	-500,00	-550,00	-606,00	
- Depreciation	-80,00	-88,00	-100,00	
- Selling, general and administrative costs (SG&A)	-100,00	-110,00	-120,00	
= Earnings before interest and taxes (EBIT)	320,00	352,00	384,00	
- Corporate tax (25%)	-80,00	-88,00	-96,00	
= NOPLAT	240,00	264,00	288,00	
+ Depreciation	80,00	88,00	100,00	
- Investments	-80,00	-88,00	-100,00	
= **Free Cash Flow**	**240,00**	**264,00**	**288,00**	**288,00**

* *after the planning period a sustainable perpetual income (terminal value) in the amount of the last detail planning period is assumed*

Additional available information:

Debt ratio	30%
Required rate of return on equity for self-financed company (k_{E-U})	17%
Corporate tax rate (T_m)	25%
Risk free interest rate (k_D) (cost of debt)	10%

With the given information the weighted average cost of capital (k_{WACC}) can be calculated with the formula of Harris and Pringle (1985), and furthermore the present value of the free cash flows can be calculated:

$$k_{WACC} = k_{E-U} - k_D * T_m * \frac{D}{CV_L} = 17\% - 10\% * 25\% * 30\% = 16{,}25\% \qquad (13)$$

Present value of FCFs	20X0	20X1	20X2	20X3	TV
FCF / PV of FCF in TV		240,00	264,00	288,00	1.772,31
Discounting factor $1/(1+0{,}1625)^t$		0,86	0,74	0,64	0,64
Present value of FCFs in t_0		206,45	195,35	183,32	1.128,13
Sum of present value of FCFs (CV_L)	**1.713,25**				

The sum of the present value of the free cash flows corresponds to the market value of the debt-financed company, the market value increasing effect of debt financing (tax shield) in the WACC-approach is already considered in the discounting factor. Finally the market value of equity is calculated:

Market value of total capital of indebted company	1.713,25
- Market value of debt (30%)	-513,98
= **Market value of equity (CV_E)**	**1.199,27**

4.1.4 Weighted Average Cost of Capital model (TCF)

As regards to completeness also the total cash flow (TCF)-approach shall be mentioned at this point as another version of the WACC-approach. The total cash flow can be calculated in the following way (Heesen, 2014):

	Earnings before interest an taxes (EBIT)
-	Interest on debt capital
=	Earnings before taxes (EBT)
-	Corporate tax
=	Earnings after interest and taxes (net profit)
+	Interest on debt capital
+/-	Expenses/income from asset disposal
+/-	Depreciation/appreciation
+/-	Creation/release of long term provisions and other cash expenses/income
-/+	Increase/decrease of net working capital
-/+	Cash flow from investments/divestitures
=	**Total cash flow (TCF)**

In contrast to the FCF-method were the tax advantage from interest on debt is included in the discounting rate, the TCF-method is including the tax shield already in the cash flow calculation. The TCF is therefore higher by the tax advantage and the following is valid (Jäger, 2013):

	Free cash flow (FCF)
+	Tax advantage from debt financing (tax shield)
=	**Total cash flow**

The TCF-approach is facing two problems. On the one hand the TCF is not financing neutral, as with the increase/decrease of interest bearing debt and its resulting interest costs the TCF can be influenced (Heesen, 2014). On the other hand a further circularity problem is occurring as for the calculation of the tax shield, the amount of debt has to be determined for each future period and therefore the company value would have to be known in advance. As for this problem the TCF is not recommended in literature and will not be considered further in this thesis (Mandl & Rabel, 1997).

4.1.5 Adjusted Present Value model

Although the WACC can be adjusted yearly to handle a changing capital structure, the APV-approach is primarily suited to handle the situation of an autonomous financing policy. Instead of managing its capital structure to a target debt-to-value ratio, this policy implies that a company plans to change its future capital structure or to determine it at a certain level (Koller et al., 2005). The APV-model separates the value of a company in three parts: the value of operations as if the company were all equity financed, the value of tax shields arising from debt financing, and the value of debt, as it is shown in figure 4.6 (Ballwieser, 2011).

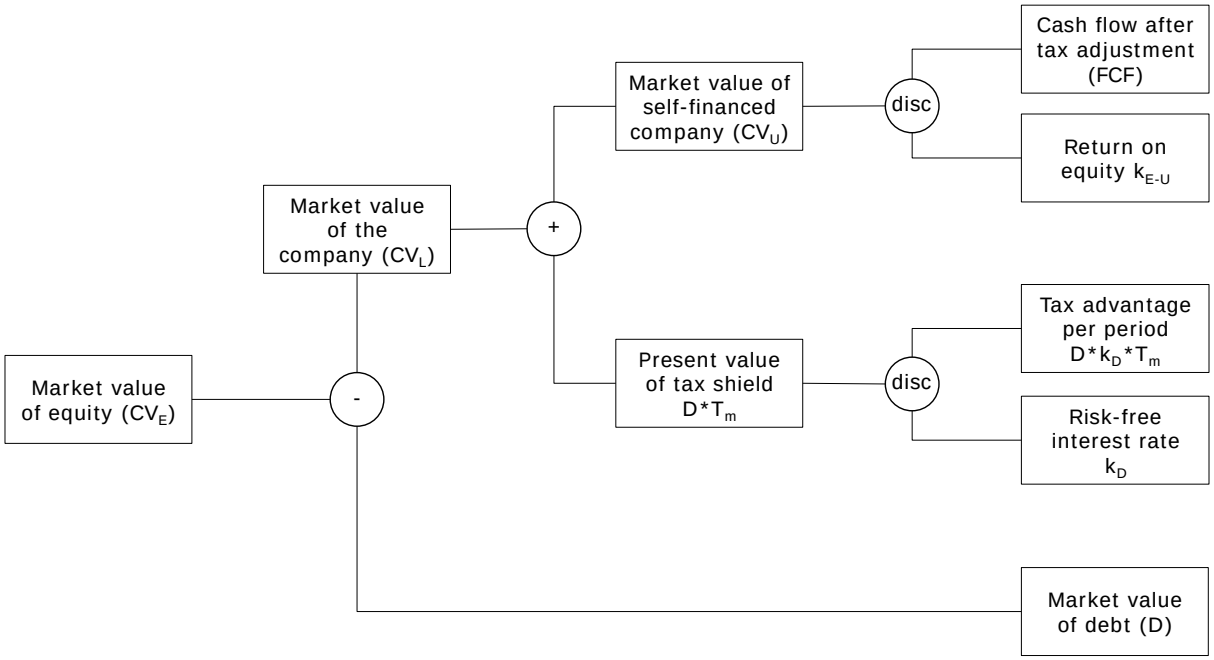

Figure 4.6: APV-approach (adapted from Drukarczyk & Schüler, 2009)

In a first step the free cash flows are calculated in the same way as already shown for the WACC-approach in the previous chapter. The FCFs are discounted with the assumed return expectations of an equity investor for a debt-free enterprise. The company value calculated in this way represents the value of the operational activities detached from any influence of the capital structure (Koller et al., 2005) and can be represented in (14) (Ballwieser, 2011):

$$CV_U = \sum_{t=1}^{T} \frac{FCF_t}{(1+k_{E-U})^t} + \frac{FCF_{T+1}}{k_{E-U} * (1+k_{E-U})^T} \quad (14)$$

In a second step, the positive effect resulting from tax savings due to the presence of debt is added to the determined present value of the fictitious self-financed company (Jäger, 2013). The value of the tax shield is calculated by discounting the tax savings with a risk free interest rate, as with the APV-approach it is assumed that the future amount of debt is determined at the date t_0 (autonomous financing policy) (Modigliani & Miller, 1963). The company value is then calculated by the sum of the first an the second step, as outlined in (15), and in a third step the value of the equity is then calculated by the subtraction of the value of debt (16) (Aschauer & Purtscher, 2011):

$$CV_L = CV_U + T_m * D \quad (15)$$

$$CV_E = CV_L - D \quad (16)$$

To sum it up, the procedure of the APV-model can be shown as the following (Heesen, 2014):

	Present value of free cash flows at capitalization with k_{E-U}
+	Market value of non-operation capital
=	Market value of the self-financed company
+	Market value increase through debt financing (tax shield)
=	Market value of company (incl. debt) (CV_L)
-	Market value of debt at t_0
=	**Market value of equity (company value) (CV_E)**

Example 2: APV-approach (adapted from Aschauer & Purtscher, 2011)

The budgeting for Example-GmbH (cf. example 1) with a three-year planning horizon looks as the following (simplified statement) and hence the free cash flow can be derived:

Free cash flow calculation	20X0	20X1	20X2	20X3	from 20X4
Net sales		1.000,00	1.100,00	1.210,00	
- Production costs		-500,00	-550,00	-606,00	
- Depreciation		-80,00	-88,00	-100,00	
- SG&A		-100,00	-110,00	-120,00	
= EBIT		320,00	352,00	384,00	
- Corporate tax (25%)		-80,00	-88,00	-96,00	
= NOPLAT		240,00	264,00	288,00	
+ Depreciation		80,00	88,00	100,00	
- Investments		-80,00	-88,00	-100,00	
= **Free Cash Flow**		**240,00**	**264,00**	**288,00**	**288,00**

Furthermore, the development of debt capital is known:

Debt capital	20X0	20X1	20X2	20X3	from 20X4
	1.200,00	1.100,00	960,00	960,00	960,00

Additional available information:

Required rate of return on equity for self-financed company (k_{E-U})	17%
Corporate tax rate (T_m)	25%
Risk free interest rate (k_D) (cost of debt)	10%

As stated above, in the first step the FCFs are discounted with the required rate of return on equity for a fictitious self-financed company k_{E-U} (17%):

Present value of FCFs	20X0	20X1	20X2	20X3	TV
FCF / PV of FCF in TV		240,00	264,00	288,00	1.694,12
Discounting factor $1/(1+0,17)^t$		0,85	0,73	0,62	0,62
Present value of FCFs in t0		205,13	192,86	179,82	1.057,76
Sum of PV of FCFs (CV_U)	**1.635,56**				

The market value increase through debt financing (tax shield) is calculated by the tax savings of the tax deductibility of the interest cost of debt:

Tax shield	20X0	20X1	20X2	20X3	TV
Debt capital	1.200,00	1.100,00	960,00	960,00	960,00
Interest cost (IC) (D_{t-1}*k_D)		-120,00	-110,00	-96,00	-96,00
Tax shield in t (IC*T_m)		30,00	27,50	24,00	24,00

As the development of the proportion of debt capital is given, the tax shields per period are also given and therefore discounted with the risk free interest rate k_D:

Present value of tax shield	20X0	20X1	20X2	20X3	TV
Tax shield or PV in TV		30,00	27,50	24,00	240,00
Discounting factor $1/(1+0,10)^t$		0,91	0,83	0,75	0,75
Present value of tax shields in t_0		27,27	22,73	18,03	180,32
Sum of PV of tax shields	**248,35**				

In the last step the market value of equity is calculated:

	Market value of the self-financed company	1.635,56
+	Market value increase through debt financing (tax shield)	248,35
=	Market value of company (incl. debt) (CV_L)	1.883,91
-	Market value of debt at t_0	-1.200,00
=	**Market value of equity (company value) (CV_E)**	**683,91**

The reasons for the difference in the result comparing example 1 and example 2 are the different assumptions for the financing policy (value-based vs. autonomous) and the different amount of debt capital.

4.1.6 Flow to Equity model

The valuation methods described in the previous chapters are calculating the value of equity indirectly by subtracting non-equity claims from company value. The flow to equity model values equity directly by discounting cash flows to equity at the cost of equity rather than at the weighted average cost of capital, as shown in figure 4.7. However, the FtE-method can be difficult to implement correctly because the capital structure is embedded in the cash flow and this makes forecasting difficult (Koller et al., 2005).

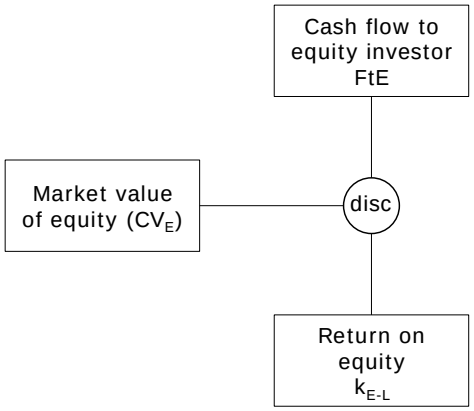

Figure 4.7: FtE-approach (adapted from Drukarczyk & Schüler, 2009)

The flows to equity can be derived either from EBIT or from the free cash flows (Ballwieser, 2011; Heesen, 2014):

	Earnings before interest an taxes (EBIT)
-	Interest on debt capital
=	Earnings before taxes (EBT)
-	Corporate tax
=	Earnings after interest and taxes (net profit)
+/-	Expenses/income from asset disposal
+/-	Depreciation/appreciation
+/-	Creation/release of long term provisions and other cash expenses/income
-/+	Increase/decrease of net working capital (w/o current interest bearing liabilities)
-/+	Cash flow from investments/divestitures
+/-	Increase/decrease of interest bearing debt
=	**Flow to Equity (FtE)**

	Free cash flow (FCF)
+	Tax advantage from debt financing (tax shield)
=	Total cash flow
-	Interest on debt capital
+/-	Increase/decrease of interest bearing debt
=	**Flow to Equity (FtE)**

The flows to equity are discounted with the required rate of return on equity for a debt-financed company and can be expressed in (17) (Ballwieser, 2011):

$$E = \sum_{t=1}^{T} \frac{FtE_t}{(1 + k_{E-L})^t} + \frac{FtE_{T+1}}{k_{E-L} * (1 + k_{E-L})^T} \quad (17)$$

The required rate of return on equity has to be calculated depending on the financing policy of the company (autonomous vs. value-based financing policy) and the development of the proportion of debt capital. Depending on the respective assumptions one of the following three formulas has to be applied for calculating the rate of return on equity for a debt-financed company (Aschauer & Purtscher, 2011):

1. Autonomous financing policy with constant debt capital

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * (1 - T_m) \frac{D}{E} \quad (18)$$

2. Autonomous financing policy with changing debt capital

In order not to over- or underestimate the value of the tax shield ($D*k_D*T_m$) if the proportion of debt capital is increasing or decreasing in the following periods, the calculation has to be adapted.

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * \frac{D_{t-1} - D_{t-1} * k_D * T_m}{E_{t-1}} \quad (19)$$

3. Value-based financing policy

As mentioned in the previous chapter, for the value-based financing policy the whole tax shield is considered as uncertain and is therefore excluded from the calculation.

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * \frac{D}{E} \quad (20)$$

An immanent problem of the FtE-approach is the circularity. In case of an autonomous financing policy it is necessary to fall back in the results of the APV-approach as for the calculation of the rate of return on equity the market value of equity is already needed. And in case of the value-based financing policy it is assumed that the capital structure is

fixed and therefore it is necessary to fall back on the results of the WACC-approach to determine the proportion of debt to calculate the FtE. In contrast to the WACC- and APV-approach in the flow to equity model it is not possible to eliminate the circularity problem with the specification of a financing policy. The FtE-approach has therefore no own solution potential and needs to fallback on an iterative approach (widely used in practice) or on the results of the WACC-/APV-approach (Krag & Kasperzak, 2015).

Example 3: FtE-approach (autonomous financing) (adapted from Aschauer & Purtscher, 2011)

The budgeting for Example-GmbH (cf. example 1 and 2) with a three-year planning horizon shows the following development of EBIT and debt capital:

	20X0	20X1	20X2	20X3	from 20X4
EBIT		320,00	352,00	384,00	384,00
Debt capital	1.200,00	1.100,00	960,00	960,00	960,00

Additional available information:

Required rate of return on equity for self-financed company (k_{E-U})	17%
Corporate tax rate (T_m)	25%
Risk free interest rate (k_D) (cost of debt)	10%

On basis of this information the flows to equity can be calculated from EBIT, or alternatively also from the free cash flows:

Flows to equity calculation		20X0	20X1	20X2	20X3	from 20X4
EBIT			320,00	352,00	384,00	384,00
-	Interest on debt capital		-120,00	-110,00	-96,00	
=	EBT		200,00	242,00	288,00	
-	Corporate tax		-50,00	-60,50	-72,00	
=	Net profit		150,00	181,50	216,00	
+	Depreciation		80	88	100	
-	Investments		-80	-88	-100	
-	Decrease of debt		-100	-140	0	
=	**Flow to Equity**		**50,00**	**41,50**	**216,00**	**216,00**

Flows to equity calculation	20X0	20X1	20X2	20X3	from 20X4
Free cash flow (FCF)		240,00	264,00	288,00	288,00
- Interest on debt capital		-120,00	-110,00	-96,00	-96,00
+ Tax shield		30,00	27,50	24,00	24,00
- Decrease of debt		-100	-140	0	0
= **Flow to Equity (FtE)**		**50,00**	**41,50**	**216,00**	**216,00**

As described above the FtE for an autonomous financed company with a changing debt proportion has to be discounted with the rate of return on equity for a debt-financed company:

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * \frac{D_{t-1} - tax\ shield_{t-1}}{E_{t-1}} \quad (21)$$

For the calculation of the equity costs it is necessary to know the debt ratio)(D-tax shield)/E) or the market value of equity, but this can only be calculated with the equity costs. To solve this circularity problem it is needed to fall back on the results of the APV-approach. The present values of the FCFs and the tax shields are discounted period specific and their sum gives the market value of the company, and thereafter the market value of the equity is computed. Now it is possible to calculate the debt ratio, which is then needed to calculate the period-specific equity costs for the debt-financed company, as shown in the following calculation:

Present value of FCFs	20X0	20X1	20X2	20X3	TV
FCF in t		240,00	264,00	288,00	288,00
Discounting factor		$1/(1+0,17)^1$	$1/(1+0,17)^2$	$1/(1+0,17)^3$	1/(0,17)
Present value of FCFs in t	1.635,56	1.673,60	1.694,12	1.694,12	1.694,12
Tax shield in t		30,00	27,50	24,00	24,00
Discounting factor (k_D)		$1/(1+0,1)^1$	$1/(1+0,1)^2$	$1/(1+0,1)^3$	1/(0,1)
PV of tax shield in t	248,35	243,18	240,00	240,00	240,00
Market value of company	1.883,91	1.916,79	1.934,12	1.934,12	1.934,12
- Debt capital in t	1.200,00	1.100,00	960,00	960,00	960,00
Market value of equity	683,91	816,79	974,12	974,12	974,12
(D - tax shield) / E	1,39	1,05	0,74	0,74	0,74

Calculation of k_{E-L}	20X0	20X1	20X2	20X3	TV
Equity costs (k_{E-U})		17%	17%	17%	17%
+ (k_{E-U} - k_D)		7%	7%	7%	7%
* (D-tax shield)/E		1,39	1,05	0,74	0,74
= equity costs (k_{E-L})		26,74%	24,34%	22,17%	22,17%

With this period-specific equity costs it is now possible to discount the flows to equity to calculate the market value of equity:

Calculation of CV_E	20X0	20X1	20X2	20X3	TV
FtE in t		50,00	41,50	216,00	216,00
Discounting factor $1/(1+k_{E-L})$		0,79	0,80	0,82	4,51
Present value of FCFs in t_0		39,45	26,33	112,19	505,94
Market value of equity	**683,91**				

The market value of equity calculated with the FtE-approach in this example is equal to the result of example 2 were the APV-approach has been applied. It can be seen that with the same assumptions about financing policy and debt capital proportion both approaches deliver the same result. In the next example it should be shown if this is also valid when the assumptions of the WACC-approach are applied for the FtE-approach.

Example 4: FtE-approach (value-based financing) (adapted from Aschauer & Purtscher, 2011)

The same assumptions for EBIT, required rate of return on equity for a self-financed company (k_{E-U}), corporate tax rate (T_m), and cost of debt (k_D) are valid as in the previous examples. It is also known that the proportion of interest-bearing debt, i.e. the debt-ratio should be 30% (cf. example 1).

The circularity problem occurs under this approach already earlier as for the calculation of the flows to equity the interest cost for debt and the change of debt are needed. For a value-based financing policy it is therefore necessary to fall back on the results of the WACC approach. As the debt proportion is changing from period to period a period specific consideration is needed. The present value of the FCF in t is the total market value of the debt-financed company in t. With the assumption of a debt ratio of 30%,

the period specific values of debt, and thereafter the interest cost of debt, the tax shields, and the change of interest bearing debt and from that the flows to equity can be calculated. The following calculation shows the results from the WACC-approach:

Present value of debt	20X0	20X1	20X2	20X3	TV
FCF in t		240,00	264,00	288,00	288,00
Discounting factor (k_{WACC})		$1/(1+k_{WACC})^1$	$1/(1+k_{WACC})^2$	$1/(1+k_{WACC})^3$	$1/(k_{WACC})$
Present value of FCFs in t	1.713,26	1.751,66	1.772,31	1.772,31	1.772,31
Debt ratio (30%)	30%	30%	30%	30%	30%
Market value of debt in t	513,98	525,50	531,69	531,69	531,69

Flows to equity calculation	20X0	20X1	20X2	20X3	from 20X4
Free cash flow (FCF)		240,00	264,00	288,00	
- Interest on debt capital		-51,40	-52,55	-53,17	
+ Tax shield		12,85	13,14	13,29	
+ Increase of debt		11,52	6,19	0,00	
= **Flow to Equity (FtE)**		**212,97**	**230,78**	**248,12**	**248,12**

For the calculation of the company value the cost of equity is needed to be determined, and this can be done with formula (22) for value-based financing as described above:

$$k_{E-L} = k_{E-U} + (k_{E-U} - k_D) * \frac{D}{E} = 17\% + 7\% * \frac{30\%}{70\%} = 20\% \qquad (22)$$

PV of FtE	20X0	20X1	20X2	20X3	TV
Flow to Equity		212,97	230,78	248,12	1.240,60
Discounting factor $(1/1+k_{E-L})^t$		0,83	0,69	0,58	0,58
Present value of FtE in t_0		177,48	160,26	143,59	717,94
Present value of FtE	**1.199,27**				

The present value of the flow to equity is equivalent to the market value of equity therefore the value of the company. The result of example 4 shows that the FtE-approach is delivering the same result as the WACC-approach if the same assumptions about the financing policy (value-based) and the amount of debt are considered. Of course there is a difference to the results of example 2 and 3, as there were taken different assumptions about the financing policy and the debt ratio.

4.2 Capital asset pricing model

For the valuation of a company using a discounted cash flow method, free cash flows are discounted with the weighted average cost of capital. One essential component of the WACC is the costs of equity that need to be estimated, and therefore the expected rate of return of the company's equity.

In the examples above the expected rate of return was given so far. However, expected rates of return cannot be observed and therefore it is necessary to rely on asset-pricing models that translate risk into expected return. The most common asset-pricing model is the capital asset pricing model (CAPM), but there are also other models as the Fama-French three-factor model and the arbitrage pricing theory (APT) (Koller et al., 2005). The capital asset pricing model is based on the portfolio theory of Markowitz and the separation theorem of Tobin, which are discussed in the next chapter.

4.2.1 Portfolio theory of risk

The portfolio theory was developed by Markowitz (1952), and is based on certain assumptions about the behavior of individual investors when they are facing risk in their investment decisions. In the model it is assumed that an investor is strictly rational, seeks to maximize his assets, and is risk avers. This means that an investor would choose out of two securities of identical risk the one with higher return, or out of two securities with identical return the one with the lowest risk.

Furthermore, in the model it is argued that a risky investment does not exist in isolation but a rational investor would hold a number of different securities, which respond differently to changing market conditions. Therefore, the risk of a portfolio is not the summation of its individual securities risks, but the standard deviation of a combined distribution of two or more risky investments is calculated to measure the risk (Ryan, 2007).

The risk equation for a portfolio of two investments is consisting of the variance (σ^2) or standard deviation (σ) of each individual investment's return, the weights by value (w) of each investment in the portfolio, and the covariance (σ_{AB}) of the two investments. The covariance measures the degree of interdependence between the two securities and is related to the correlation coefficient in the following way (Kuhner & Maltry, 2006):

$$\sigma_{AB} = \rho_{AB}\sigma_A\sigma_B \tag{23}$$

The value of the correlation coefficient ρ_{AB} takes a range form -1 to +1, where the returns of the two investments are perfectly negatively related and the returns are perfectly positively related. A correlation of -1 would mean that return of A is increasing in the same amount as the return of B is decreasing, and the risk could be excluded completely (Kuhner & Maltry, 2006).

The overall risk of a portfolio with two investments is measured by the standard deviation of the returns, as shown in (24) (Aschauer & Purtscher, 2011):

$$\sigma_P = \sqrt{w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B \sigma_{AB}} \tag{24}$$

In case a negative number is inserted for the covariance (σ_{AB}) in (24) the standard deviation of the portfolio is lower than the weighted average of the standard deviation of each investment. With the variation of the weightings by value of the investment in each option the portfolio return and risk are changing and various return-risk-combinations can be created (Ryan, 2007).

When a portfolio is consisting of a large number of securities, the variance of the portfolio is mostly determined by the correlation of the returns of the securities. The lower the correlation between the securities of a portfolio is, the lower is also the variance of the portfolio and therefore also the overall risk.
Furthermore, the higher the number of securities the greater is the diversification effect and with an increasing number of securities in a portfolio the risk of the portfolio (measured in its standard deviation) is decreasing to a certain level (Loderer et al., 2010).

In figure 4.8 this relation can be seen as the risk of a portfolio of randomly selected securities is decreasing by the number of securities in the portfolio. With ten securities in a portfolio, most of the effect is already realized, and with a number of 30 securities, there is very little remaining benefit if more are added. This would imply that a

collection of about 30 stocks, if truly randomly chosen, provides all possible benefits of diversification. Such a portfolio is called a well-diversified portfolio (Ross et al., 2003).

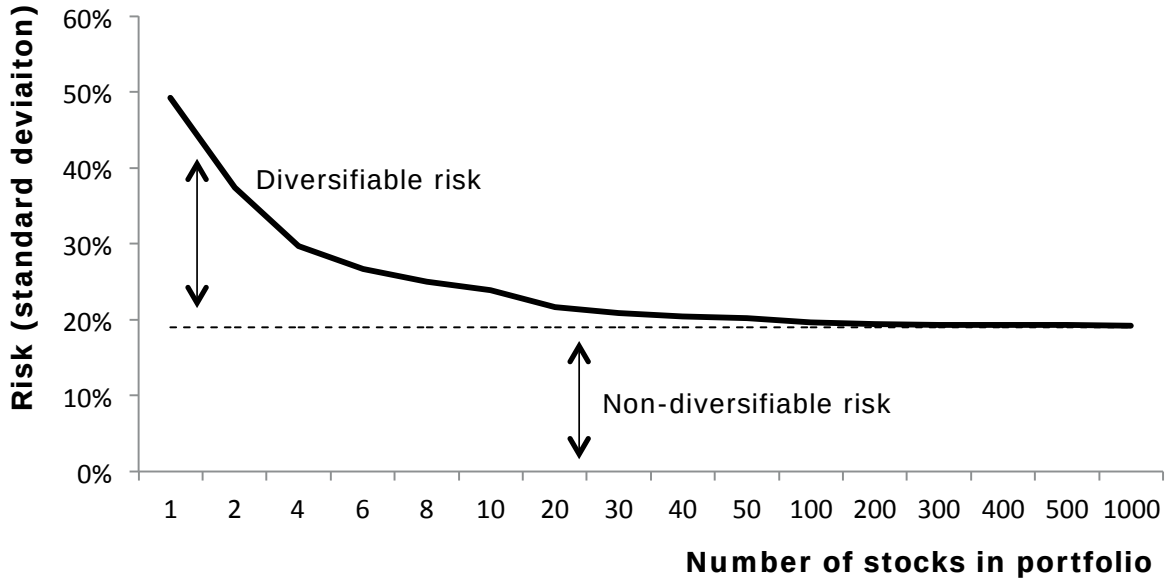

Figure 4.8: Portfolio diversification (adapted from Ross et al., 2003)

Figure 4.8 shows that there two types of risk existing. One is unsystematic risk (diversifiable risk or asset-specific risk) that is particular to a single asset, e.g. development of a new product or an industrial accident. Unsystematic risk can be reduced or almost eliminated by diversification of a portfolio. The other type is systematic risk (non-diversifiable risk or market risk) that affects almost all assets to a certain degree and is caused by the economic situation e.g. interest rates of inflation (Ryan, 2007).

The described diversification effects are not only valid for investments on the capital market but occur also when investments are done in real estate or in real economy goods (Loderer et al., 2010).

4.2.2 Separation theorem – capital market line

Tobin (1958) has extended the portfolio theory of Markowitz with the implementation of further assumptions into a market model or market perspective. This market perspective is only possible under the following premises.

The investors have homogenous expectations about expected value, standard deviation, and covariance of all investment possibilities, and therefore an information effective capital market is assumed. Furthermore, all investors could beside investing in a risky investment also invest in a risk free at a risk free rate of return (i_r), and also borrow money at the same rate as well.
Due to the consistent perception of return rates, variances, and covariance within the risky investment only one single portfolio would be relevant for all investors. This portfolio would theoretical include all possible securities available on the capital market, thus the highest diversification effect could be reached. All investors would therefore identify the same tangency portfolio or market portfolio that perfectly represents the total market for risk (Ryan, 2007).

The adjustment of the investment strategy of each investor would not be done by changing the composition of the risky portfolio, but by the proportion of the investor's fund invested in the market portfolio compared to the amount invested in risk free securities. In this way the fund selection problem is separated from the asset allocation decision.
The Tobin separation theorem implies that all investors in the capital market will take the efficient market portfolio as their sole investment vehicle for risky investments. If an investor is more risk tolerant than the average he could leverage his portfolio by borrowing money and invest more into the market portfolio, or if the investor is less risk tolerant he can depress the risk of his investments by depositing some money at the risk free rate.
The capital market line is answering the question, which return the market is demanding for a certain risk occurring from the mixture of investment in the market portfolio and the risk free interest rate. However, it is not possible to determine the price for a certain security (Kuhner & Maltry, 2006).

4.2.3 Capital asset pricing theory

The above described conclusions of the portfolio theory and the separation theorem have lead to the most known capital market model, the capital asset pricing model (CAPM) developed in the 1960s by Sharpe (1964), Lintner (1965), and Mossin (1966) independently. The capital market line is used to define the global return, whereas the

CAPM tries to define the price for a single security of the market portfolio. This should be possible as each security is part of the market portfolio and therefore its value can be expressed in relation to the market portfolio.

A reference point is the market risk premium that an investor is expecting when investing in the market portfolio for the take over of risks. The market risk premium (mrp) is the difference of the market return (r_m) and the risk-free interest rate (i_r). The beta factor (β_j) is putting the valuation relevant security-specific risk in relationship with the market risk and measures the sensitivity to the market.
If the security-specific risk corresponds to the market risk then the beta factor would be 1. Values of the beta factor higher (lower) then 1 are signaling a higher (lower) risk of the security compared to the market risk (Drukarczyk & Schüler, 2009).

The beta is the ratio of the covariance of the security's return with the return of the market portfolio to the variance of the market portfolio's return, as can seen in (25) (Ballwieser & Hachmeister, 2013):

$$\beta_j = \frac{\sigma(r_j; r_m)}{\sigma(r_m)^2} \tag{25}$$

The expected return $E(r_j)$ for an investment of equity in a security, project or basically a company j is calculated in (26) (Ryan, 2007). The expected return on equity is therefore the costs of equity (k_E) that has so far been given in the examples calculated in the previous chapters.

$$E(r_j) = i_r + (r_m - i_r) * \beta_j \tag{26}$$

In the equilibrium of the capital market exists a fixed relationship of return and risk. The market risk premium (additionally to the risk free rate) is increasing proportionally with the increase of the systematic risk, measured in β_j. This linear connection is called security market line and is shown in figure 4.9 (Ross et al., 2003).

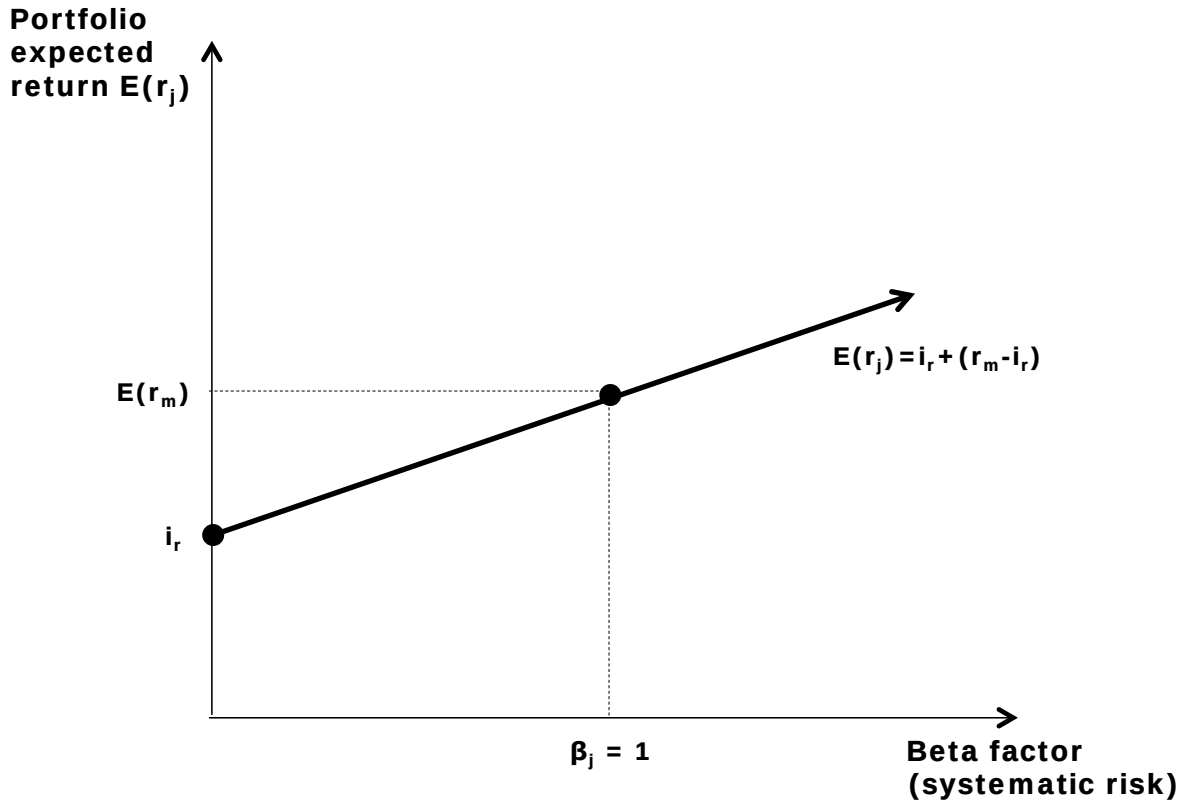

Figure 4.9: Security market line (adapted from Ross et al., 2003)

The expected return of an investor for any given risky investment is the sum of the risk free rate of return and a risk premium. The risk premium is rewarded to the investor for carrying market driven risk, which is created through exposure to systematic, non-diversifiable risk. The advantage of the CAPM is that all factors that flow into the model can be determined from the capital market and therefore the measurement of risk is verifiable (Coenenberg, 1992).

4.3 Valuation using multiples

4.3.1 Overview

As described in the previous chapter, the discounted cash flow method is the most accurate and flexible approach used for valuing projects, divisions, and companies. However, any analysis is only as accurate as the forecasts it relies on. This means any error in the estimation of the key parameters for the discounted cash flow approach, such as the projected future cash flow or the WACC can lead to failures in valuation and, ultimately, to strategic errors (Koller et al., 2005).
This is the reason why also the expert opinion of the "Austrian Chamber of Public Accountants and Tax Advisers for the Valuation of Businesses" has defined the requirement that the results of the DCF-calculation have to be checked on plausibility through the application of a multiples valuation method (KFS/BW1, 2014).

A carefully conducted multiples analysis, comparing a company's multiples versus those of comparable companies, can be useful to test the plausibility of cash flow forecasts, and explain mismatches between a company's performance and that of its competitors. Furthermore, the analysis can help to generate insights into the key factors creating value in an industry (Koller et al., 2005).

The market approach is based on the assumption that the prices achieved on the capital market are fair prices and therefore it makes sense to use these prices for the valuation of securities and also for companies not listed on the stock exchange. Although this assumption is based on a market with perfect competition, the common opinion is that the prices on the capital market are the best approximation of the "fair price".
The popularity of using multiples for the valuation in the Anglo-American financial markets is based on the high volume of corporate transactions and hence the wide range of available market data (Kranebitter, 2007).

As shown in figure 4.10, in a first step a multiple is calculated as a ratio of the known market value of a comparable company and a reference factor of its financial performance. In a second step the reference factor of the company to be valued is multiplied with the multiple to calculate the potential market price (Wagner, 2005).

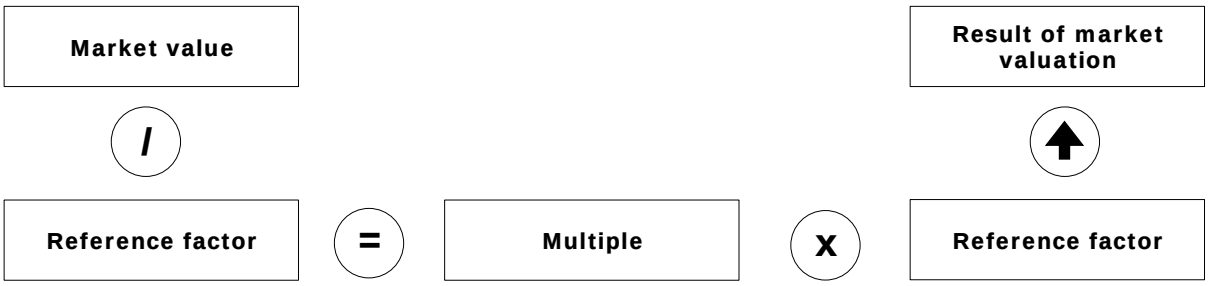

Figure 4.10: Multiples valuation approach (adapted from KPMG, 2014)

The following key financial statistics, ratios, and other metrics are typically used as reference factors (Rosenbaum & Pearl, 2009):

- Profitability (gross profit, EBITDA, EBIT, and net income margins)
- Growth profile (historical and estimated growth rates)
- Return on investment (ROIC, ROE, ROA, and dividend yield)
- Credit profile (leverage ratios, coverage ratios, and credit ratings)
- Operational figures (e.g. number of customers/clients)

The market value of the company is depending on the used reference factor either enterprise value (EV) (a synonym of company value CV_L) or equity value (CV_E). For the calculation of the market value the two most commonly used methods are the comparable companies analysis, also called “market multiples” or “trading comps” and the comparable transaction analysis, also called “precedent transactions analysis” or “transaction comps”.
The first one is based on the stock prices of comparable companies that provide a market benchmark. The second one is considering market information of recently (within the last two to three years) performed M&A transaction (Rosenbaum & Pearl, 2009).

The third approach is the simplified multiples approach, which is based on industry-specific experience and is mostly used for the valuation of medium-sized companies (Ernst et al., 2010).

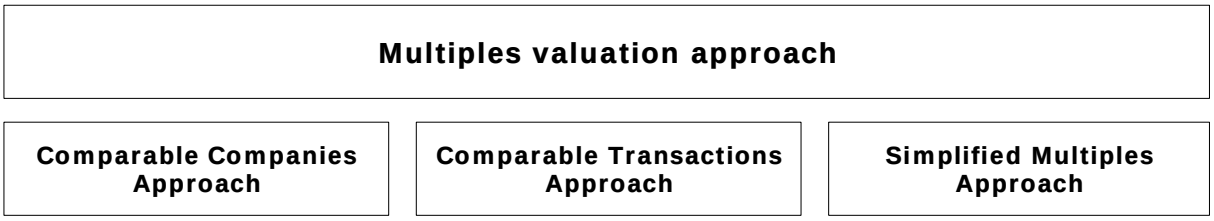

Figure 4.11: Multiples valuation methods

What has to be considered is that under normal market conditions, transaction comparables tend to provide a higher multiple range than trading comparables for two principal reasons.
First, buyers usually pay a “control premium” when purchasing another company and in return receive the right to control decisions regarding the target’s business and its underlying cash flows. Whereas the price paid for a single share on the stock exchange represents only the price for a minority interest.
Second, strategic buyers often try to realize synergy effects that lead to cost savings, growth opportunities, and other financial benefits due to the combination of two businesses, and are therefore paying higher purchase prices (Wagner, 2005).

Investigations of the US market prove that on average a 40% markup on the stock market price is paid in company transactions (Kuhner & Maltry, 2006).

4.3.2 Theoretical background

a. Selection of the base year

A critical aspect is the selection of the base year as the multiples approach is based on a single period. For the base year is usually a fiscal year in the future chosen, as companies are traded on the stock exchange based on expectations of their future performance. The usage of historical data can only be justified in exceptional cases if no estimations are available. The historical data is used for plausibility checks. In practice the reference values are used on basis of a one to two year forecast (Schacht & Fackler, 2009).

b. Connection of DCF and multiples

The basic principal of valuation is that investors are not interested in a company itself but rather on its ability to generate earnings and the growth of the company in the future. This means also the valuation with multiples has to focus more on the future earnings and growth of a company and not its history. This leads to the question how growth (g) is reflected in the multiples (Koller et al., 2005).

The growth rate (g) of the earnings can be calculated (27) from the earnings retention rate (b) that is the proportion of earnings that are invested back into the business and the return on invested capital (ROIC) (Drukarczyk & Schüler, 2009):

$$g = b * ROIC \tag{27}$$

The answer is that growth is influencing the multiple but only in combination with a healthy return on invested capital (ROIC). To see how ROIC and growth drive multiples in the key value driver formula (28) NOPLAT has been disaggregated by EBITA and the company's tax rate (29), and then both sides divide by EBITA to build a pretax enterprise-value (EV) multiple (30) (Koller et al., 2005):

$$EV = \frac{NOPLAT(1 - \frac{g}{ROIC})}{WACC - g} \tag{28}$$

$$EV = \frac{EBITA(1 - T_m)(1 - \frac{g}{ROIC})}{WACC - g} \tag{29}$$

$$\frac{EV}{EBITA} = \frac{(1 - T_m)(1 - \frac{g}{ROIC})}{WACC - g} \tag{30}$$

Formula (28) gives a better understanding for the assumption that companies can be compared. The market value of a company can be used to value another company if similarities of the tax framework (T_m), the risk of investment (WACC), the earnings retention rate (b), and the return in invested capital (ROIC) are given. This implies that an investor has to collect the same parameters that are necessary for the DCF method

also for the comparable companies and the target company. Therefore the valuation using multiplies can be transferred into a simplified DCF-model without periods (Drukarczyk & Schüler, 2009).

The connection of the multiples- and the DCF-approach is only valid with single annuity, and this is actually the weakness of the multiples approach that is critisized in theory and why the DCF-approach is considered as superior (Ballwieser, 2011). However, the critics overlooked the fact that also in the DCF-method the terminal value amounts usually for 60% to 80% of the total company value and the advantage is only based on the necessity of deeper analysis and plausibility checks of the financial planning (Aschauer & Purtscher, 2011).

4.3.3 Selection of the comparable group

a. Analysis of the target company

Before the search and selection process of comparable companies or transactions can be started it is crucial to know the characteristics of the target company that should be valuated. As a starting point of the Porter's five forces analysis can be applied, which is a framework to analyze the competition within an industry, see figure 4.12.
The five forces (threat of potential entrants, threat of substitutes, bargaining power of suppliers and customers, and the rivalry within the industry) are an indicator of the intensity of competition and profit potential within an industry. It is valid that the higher the combined strength of the five forces is, the stronger is also the competition, and therefore the lower is the profitability (Kranebitter, 2007).

The knowledge of the characteristics of the target company is essential for making decisions regarding the selection of appropriate comparable companies. The analysis of the business and financial profile of the target company should include the following aspects (Wagner, 2005):

- Sector/industry
- Business model
- Size of the company
- Growth profile
- Profitability/return on investment

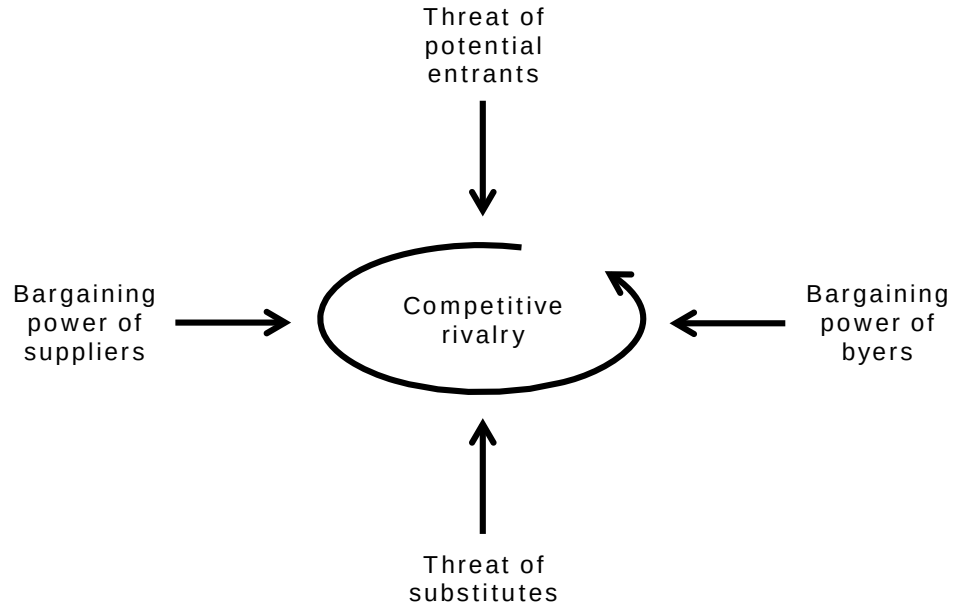

Figure 4.12: Porters Five Forces (adapted from Porter, 2004)

The first selection criterion to look at is the sector where the target company is active in. The sector refers to the industry or markets in which a company operates e.g. consumer products or industrials. Usually a sector can then be further distinguished into sub-sectors. It can be assumed that companies within one industry have similar characteristics in regards to profitability, growth, and risk (Rosenbaum & Pearl, 2009).

However, not every company with in one sector or sub-sector can be compared with each other as their business model might differ heavily. So it is also important so analyze the respective business model of the company as it affects its cost structure and risk exposure (Gutmann, 2013).

The second selection criterion is the size of the company that is usually measured in financial metrics such as market capitalization, revenue, or total balance sheet but also non-financial metrics such as number of employees or number of store locations is possible.
Significant differences in size are normally reducing the comparability as companies of similar size are more likely to be analogous in other aspects as well (e.g. economies of scale, purchasing power, or pricing leverage). However, it is often difficult to find similar

companies of similar size, especially when valuing a very large or very small company. In this case data from companies with similar size should be more trusted, adjustments of the multiple may be applied, and the results interpreted under consideration of this circumstance (Aschauer & Purtscher, 2011).

The third selection criterion is the company's growth profile that is determined by its historical and estimated future financial performance. Equity investors usually reward high growth companies with higher trading multiples than slower growing peers (Gutmann, 2013).

The fourth selection criterion is the company's profitability and its return on investment. Profitability measures its ability to convert sales into profit and is therefore a ratio of profit in the numerator (e.g. EBIT) and sales in the denominator. As a general rule, higher profit margins translate into higher valuations, under the assumption of companies in the same sector with similar characteristics.
Return on investment (ROI) measures a company's ability to provide earnings to its capital providers and the most commonly used metrics are return on invested capital (ROIC), return on equity (ROE), and return on assets (ROA) (Rosenbaum & Pearl, 2009).

Beside these quantitative factors also qualitative factors such as market penetration, market share, diversification, internationalization, and the evaluation of the life cycle of the target company are considered (Wagner, 2005).

b. Selection of comparable companies

Once the target's business and financial profile is analyzed and understood the search for comparable companies can be started. A starting point is to identify the direct competitors of the target company as they generally share key business and financial characteristics. Some companies name their competitors in their annual report. If the competition is not disclosed then an industry classification system such as the Standard Industrial Classification (SIC) code or the Global Industry Classifications Standard (GICS) system can be helpful (Koller et al., 2005).

c. Selection of comparable transactions

In a first step the goal is to locate as many potential transactions as possible for a relevant, recent time period and then further refine the universe later on. The most common sources are databases of M&A transactions that allow the screening of M&A transactions through multiple search criteria. Another source can be the targets own M&A history and the multiples it has paid and received for previous transactions, or the M&A history of comparable companies.

The comparable companies are therefore selected as described in the chapter before. Furthermore equity research report of the target, its comparable companies, and sector can be review as they may provide also lists of comparable acquisitions (Gutmann, 2013).

Other aspects that should be considered in the analysis of comparable transactions are the market conditions of each transaction and which specific circumstances have surrounded the given transaction. The market conditions reflect the business and economic environment and must be viewed within the context of the specific sector and its cycles. As well the atmosphere at the capital markets, at the time of a given transaction should be considered. In the analysis of the deal dynamics questions such as: Was the acquirer a strategic buyer or a financial sponsor? What were the motivations of the transaction? Was the target sold through a negotiated sale or an auction process? Was the takeover friendly or hostile? should be answered (Rosenbaum & Pearl, 2009).

In the process of the valuation the evaluator has to decide if it is possible to consider all the above-named characteristics and selection criteria for the choosing of the most appropriate comparable companies or transactions. Nevertheless it is important to have a statistically significant number of comparable data, whereby five comparables are usually the minimum requirement (DVFA, 2005; Kranebitter, 2007).

4.3.4 Valuation multiples

There are a huge numbers of multiples existing that can be used for the valuation of a company. Basically they can be distinguished in enterprise-value- and equity-value-multiples. The most common ones for both categories are shown in figure 4.13.

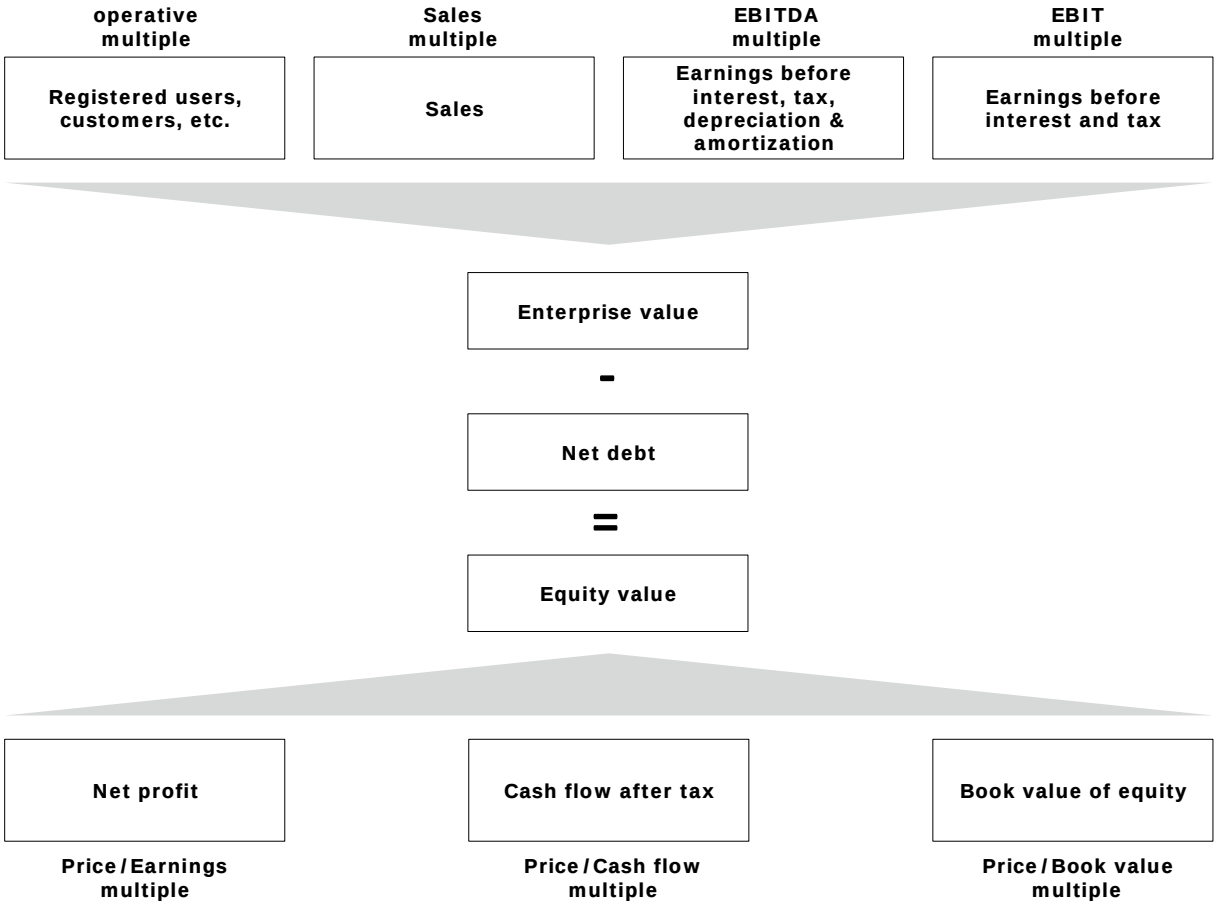

Figure 4.13: Common valuation multiples (adapted from KPMG, 2014)

The consistency of numerator and denominator for the calculation of a multiple is of great importance. Enterprise value multiples should have a reference factor before tax and equity value multiplies a reference factor after tax. A theoretical advantage of enterprise multiples is that they are independent of the debt ratio under certain premises. Beside the selection of comparable companies another key task of the multiples valuation approach is the selection of a suitable value indicator.

Usually the compared companies will differ to a greater or lesser extent, therefore the selection of a specific multiple could lead to an inaccurate value determination. In order to prevent this, in practice there is always a certain amount of multiples calculated (Wagner, 2005).

a. Operative multiples (Rosenbaum & Pearl, 2009)

For the calculation of operative multiples a non-financial performance indicator or value driver is used that is specific for the respective sector. The following list shows some examples for certain industries. The advantage of these multiples is that they cannot be influenced from accounting policies and can also be applied in case other performance data is not available.

- Telecommunication – Access Lines/Fiber Miles
- Retail – Sales floor (in square meters)
- Oil & Gas – Exploration expense
- Paper and Forest Products – Production/Capacity (in units)

b. Enterprise value / EBIT multiple (Krolle, 2005)

In the numerator of the EV/EBIT-multiple is the total company value of the comparable company (market value of the equity in terms of stock market capitalization, and market value of net debt). In the denominator is the EBIT, usually the expected EBIT for planning year 1 or 2 (this is also valid for the multiples afterwards, and the respective reference value in the denominator). For all comparable companies the following equation needs to be calculated (31):

$$EV/EBIT\ multiple = \frac{EV_0}{EBIT_1} \tag{31}$$

The calculated multiples of each company are then compressed into a mean multiple of the peer group. This procedure will be explained later.

An advantage of all EV-multiples is that effects coming from debt ratio should be compensated and therefore a comparison of companies with different capital structures is possible. In cases of different capital intensity also the EBIT multiple should be used. The EV/EBIT-multiple should not be used for companies that have different depreciation procedures.

c. Enterprise value / EBITDA multiple (Schacht & Fackler, 2009)

The EBITDA-multiple is defined as enterprise value divided by EBITDA (earnings before interest, tax, depreciation, and amortization) (32):

$$EV/EBITDA\ multiple = \frac{EV_0}{EBITDA_1} \tag{32}$$

As an advantage of this multiple can been sent that it is free of any influences due to suffrages regarding depreciation, amortization, and capital structure. However, the collection of the respective data will be difficult especially for companies not listed on the stock exchange.

d. Enterprise value / sales multiple (Schwetzler & Warfsmann, 2005)

In principal the future earnings and cash flow values are the basis of any company valuation. A deviation from this principle is only then useful in case there are no representative income figures available. This can be the case typically with high-growth companies that often have negative income figures in the first years and therefore problems occur due to negative reference factors if e.g. EBIT would be used.

This is solved usually with the usage of a reference factor that cannot have a negative value such as sales. But it has to mention that this can only be seen as an auxiliary construction and will only deliver justifiable results under very restrictive assumptions. The EV/sales-multiple is defined in (33):

$$EV/sales\ multiple = \frac{EV_0}{Sales_1} \tag{33}$$

e. Price / earnings multiple (Adrian, 2005)

The application of the price/earnings-multiple or just P/E-ratio is one of the fundamental methods for the valuation of share, as the availability of the needed information is high. It is calculated as current share price divided by diluted earnings per share (EPS) (or equity value divided by net income) (34):

$$P\ /\ E\ multiple = \frac{share\ price}{diluted\ EPS} = \frac{equity\ value_0}{net\ income_1} \tag{34}$$

The number of diluted shares is calculated by adding the number of shares represented by its in-the-money options, warrants, and convertibles securities to its basic shares outstanding. Diluted EPS indicates a "worst case" scenario, where all outstanding options, warrants, and convertible securities are converted into shares and therefore the EPS is reduced due to the increase of shares (Rosenbaum & Pearl, 2009).

For the application of the P/E-ratio it has to be considered that the same parameters as for the calculation of the return on equity have to be determined. This includes the costs of equity, profit growth, earnings retention rate, the return in invested capital (has to be higher as the costs of capital) and the duration of competitive advantage that comes along with it. Therefore all these parameters have to be analyzed and assessed if surcharges or discounts are necessary in comparison with the peer group.

A disadvantage of this multiple is that earnings is by tendency the one performance indicator that can be influence the most due to account policy. Furthermore, the value could be influenced by extraordinary or aperiodic effects and needs to be adjusted consequently.

f. Price / earnings-to-growth multiple (Schacht & Fackler, 2009)

In the P/E-ratio are no expectations of the future growth of earnings explicitly included and therefore the price/earnings-to-growth ratio (PEG) has been developed. It is calculated as P/E divided by expected earnings growth (35):

$$PEG\ multiple = \frac{\frac{share\ price_0}{EPS_1}}{g_1} \tag{35}$$

The PEG is used for the valuation of high-growth companies, as the PEG is in case of high growth rates more stable then the P/E-ratio and is reacting less sensitive on changes of the growth rate. In situations of lower growth rates the PEG is not recommended as in this cases it is reacting more sensitive.

With the PEG-multiple exists an alternative that is considering profit growth in a simplified calculation compared to the DCF-approach. Furthermore the collection of

relevant data is also uncomplicated as only three input factors are needed, in particular the current share price, earnings expectation of the base year, and the growth rate.

g. Price / book value multiple (Kuhlmann, 2005)

The price/book-value ratio or just P/B-ratio is considered as a simple to collect valuation criteria for investors to identify undervalued stock. In this context stock is contemplated as undervalued if the market capitalization is significant below the book value of the equity respectively the share price is significant below the book value of the equity per share (36). However, it cannot be said that a company is as much more attractive the lower the P/B-ratio is, because under such a circumstance also a company with low ROE or a low growth rate and/or high risk could be selected.

$$P\ /\ B\ multiple = \frac{equity\ value_0}{equity_0} \tag{36}$$

As the P/B-ratio is dependent on the ROE a combined analysis of this two key figures would lead to a more reasoned decision as in a normal case a company with a high P/B-ratio should also have a high ROE. Combinations of ROE and P/B an their respective assumption are shown in figure 4.14.

P/B	ROE	Declaration
High	High	Reasonable valued
High	Low	Overvalued if ROE cannot be increased significantly
Low	High	Undervalue if high ROE can be retained
Low	Low	Reasonable valued

Figure 4.14: typical combinations of P/E-ratio and ROE

An advantage of the price/book value multiple is its simple calculation and the relative stable value in course of time. But the book value of equity brings also a disadvantage along, namely differences in the accounting of equity according to the different accounting standards. It is for this reason that the P/B-ratio should only be used as a supporting performance indicator.

h. Price / cash flow multiple (Trageser, 2005)

The price/cash flow multiple (P/CF-ratio) is ranked among the most frequent used approaches in practice. The multiple is calculated as price per share divided by cash flow per share (37).

$$P\ /\ CF\ multiple = \frac{share\ price_0}{CF\ per\ share_1} \tag{36}$$

The definition of cash flow used in the circumstance differs from the definition that has been made for the discounted cash flow methods as in this case is based only on the cash flow of the first base year. It is calculated from annual net profit, adjusted by any one-time influences after tax, and adjusted for all regularly accruing non-cash expenses or incomes.

In conclusion the empirical results demonstrate that the price/earnings-ratio and the price/book value-ratio produce the best results respectively the least estimation-error, whereas the highest valuation error occurs by the usage of the EV/sales-multiple (Barthel, 2007).

4.3.5 Compression of multiples and calculation of company value

After the collection of data of the comparable companies and the calculation of the multiples the next step is to compress the various numbers of multiples to one "representative" multiple for the target company. Without compression of the multiples and direct application on the target company the calculation would lead to a very large range of estimations for the equity value, as it can be seen in the example afterwards. Usually the calculation is not done with one single multiple but instead with several multiples and the results are shown in a range (Aschauer & Purtscher, 2011).

For the calculation of condensed multiples the common statistical methods such as arithmetic mean, median, or the harmonic mean can be applied. As outliers can distort the arithmetic mean the median is favored in practice instead (Freiburg & Timmreck, 2004). Another option to eliminate outliers is the application of the harmonic mean,

which is recommended to be used as it implies a recourse on the average costs of equity (Drukarczyk & Schüler, 2009).

Example 5: multiples approach (adapted from Drukarczyk & Schüler, 2009)
The Example GmbH that has already been valued in the previous examples should now also be valued using the multiples approach to make a plausibility check. The respective data of three comparable companies can be found hereafter. The value for book and market value apply for the previous fiscal year, the payment and earnings surpluses are the expectation for the ongoing fiscal year (forward looking multiples).

	Example GmbH	Comparable 1	Comparable 2	Comparable 3
Market value of equity		1.640,00	1.600,00	1.100,00
Interest bearing debt	1.200,00	2.400,00	3.600,00	1.300,00
Enterprise value (EV)		4.040,00	5.200,00	2.400,00
Book value of equity	480,00	1.200,00	1.400,00	650,00
Cost of debt (k_D)	10,00%	6,00%	5,00%	6,00%
Cost of equity (k_E)		10,00%	9,00%	14,00%
Sales	1.000,00	2.000,00	3.000,00	1.600,00
- Production costs	-500,00	-1.000,00	-1.760,00	-1.080,00
- SG&A	-100,00	-160,00	-200,00	-120,00
= EBITDA	400,00	840,00	1.040,00	400,00
- Depreciation	-80,00	-220,00	-280,00	-100,00
= EBIT	320,00	620,00	760,00	300,00
- Interest	-120,00	-144,00	-180,00	-78,00
= EBT	200,00	476,00	580,00	222,00
- Corp. tax (25%)	-50,00	-119,00	-145,00	-55,50
= Net income	150,00	357,00	435,00	166,50

From this data the multiples for the comparables can be calculated.

	Multiples of comparable company			Value of equity of Example-GmbH based on multiples of		
	A	B	C	A	B	C
EV/Sales	2,02	1,73	1,50	820,00	533,33	300,00
EV/EBITDA	4,81	5,00	6,00	723,81	800,00	1.200,00
EV/EBIT	6,52	6,84	8,00	885,16	989,47	1.360,00
P/E-ratio	4,59	3,68	6,61	689,08	551,72	990,99
P/B-ratio	1,37	1,14	1,69	656,00	548,57	812,31

It can be seen in figure 4.15 that if the equity value of the target company is directly calculated without any compression of the multiples, the estimated values of equity are spread over a large bandwidth.

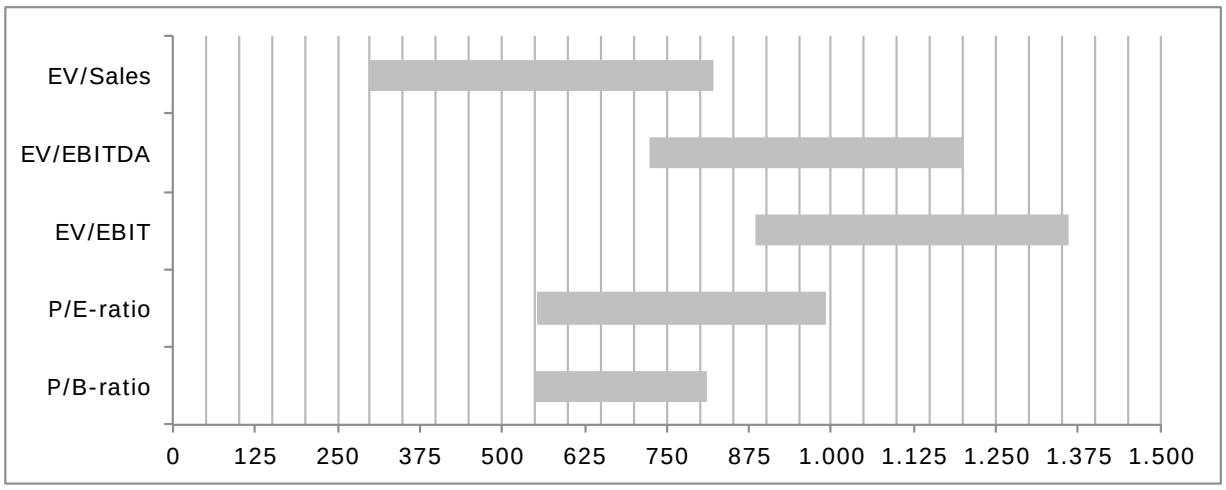

Figure 4.15: Market value of equity calculated with non-compressed multiples

Therefore the multiples are condensed using the statistical methods arithmetic mean, median, and harmonic mean.

	Multiples of comparable company			**Peer group**		
	A	B	C	Arithmetic mean	Median	Harmonic mean
EV/Sales	2,02	1,73	1,50	1,75	1,73	1,73
EV/EBITDA	4,81	5,00	6,00	5,27	5,00	5,22
EV/EBIT	6,52	6,84	8,00	7,12	6,84	7,07
P/E-ratio	4,59	3,68	6,61	4,96	4,59	4,68
P/B-ratio	1,37	1,14	1,69	1,40	1,37	1,37

With this condensed multiples the enterprise value and the equity value of the Example GmbH can be calculated.

	Arithmetic mean	Median	Harmonic mean
Enterprise value			
EV/Sales	1.751,11	1.733,33	1.725,49
EV/EBITDA	2.107,94	2.000,00	2.088,45
EV/EBIT	2.278,21	2.189,47	2.260,85
P/E-ratio	1.943,93	1.889,08	1.902,11
P/B-ratio	1.872,29	1.856,00	1.855,26

	Arithmetic mean	Median	Harmonic mean
Value of equity			
EV/Sales	551,11	533,33	525,49
EV/EBITDA	907,94	800,00	888,45
EV/EBIT	1.078,21	989,47	1.060,85
P/E-ratio	743,93	689,08	702,11
P/B-ratio	672,29	656,00	655,26

In figure 4.16 are the condensed bandwidths of each multiple portrayed within the initial larger range, but as expected the multiples are still showing a broad range of values. However, the values calculated with the price/earning-ratio and the price/book value-ratio based on the harmonic mean deliver results than come close to the result that has been calculated when using the APV-approach in example 2, which was a market value of equity of 684.

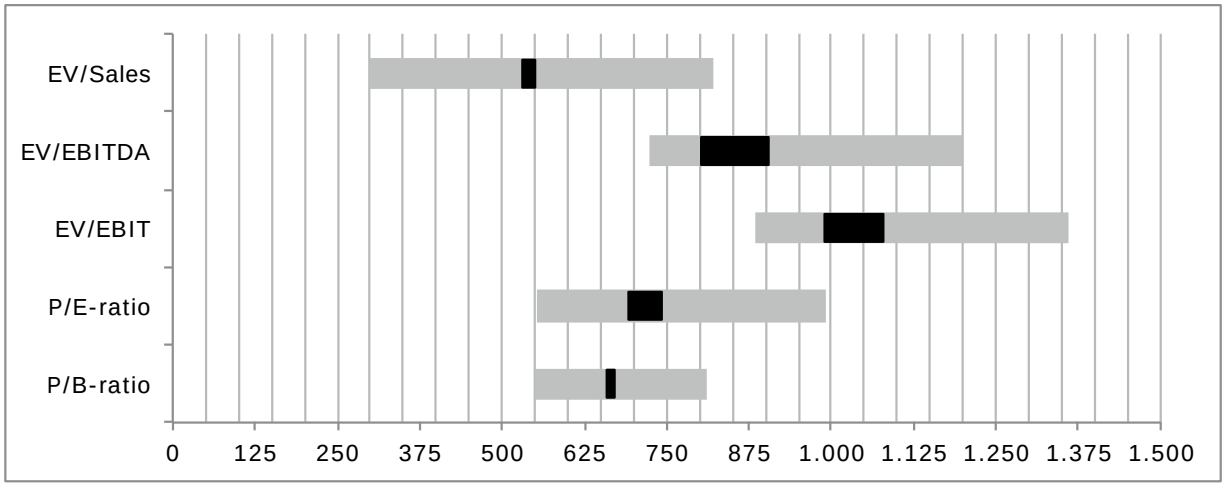

Figure 4.16: Market value of equity calculated with compressed multiples

4.3.6 Simplified multiples method

In contrast to the complex selection process of comparable companies in the valuation process of the multiples methods, is the simplified multiples method using industry specific multiples. The multiples of this approach are based on the experience of previous transactions of medium-sized companies from which so-called rules of thumbs can be derived (Kranebitter, 2007).

These multiples are generally based on the comparable transaction approach, whereas the specific selection of transactions is not done but the multiples are more or less rough experience values from previous transactions. This approach requires only the assignment to a specific industry and the knowledge of the respective multiples. Depending on the intended sector the multiples can obtain different profit, cash flow, and sales multiples (Mandl & Rabel, 1997).

4.4 Conclusion

The DCF-methods are estimating the present value of a company by discounting future payments and are based on the capital market theory of Modigliani/Miller (Jäger, 2013). The individual variants of the discounted cash flow-method distinguish themselves basically in the manner of calculating the shareholder value directly (equity approach) or indirectly (entity approach), and how the tax advantage due to debt financing (tax shield) is used (Spremann & Ernst, 2011).

For the estimation of the capitalization interest rate the DCF-methods fall back on the capital asset pricing model, that links the expected return on any risky investment with the risk free rate of return plus a risk premium. As the results of the DCF-methods are basically dependent on the assumptions taken, a multiples analysis can be useful to test the plausibility of the results of the discounted cash flow methods (Koller et al., 2005).

For the calculation of the company value the two most commonly used methods are the comparable companies analysis and the comparable transaction analysis (Rosenbaum & Pearl, 2009). It has been shown in the example calculated that the multiples approach has worked out as a plausibility check for the results calculated with the DCF-methods.

5 Valuation in practice

In practice the valuation of a company is usually done for the purpose of creating a basis for an economic decision. Therefore, the valuation process should not be a simple and unreflecting processing of the submitted historical data and the financial planning. It should also not rely on the analysis, the experience, and the judgment of a single person, but be the result of a profound teamwork of experts from various corporate divisions. The valuation of a company needs an in-depth analysis of the valuation object and its environment, on basis of that then the future development of the company can be estimated, which is then discounted with the involvement of risks and chances to a company value (Kranebitter, 2007).

5.1 Process of valuation

A valuation process starts with the analysis of the valuation object, it's historical performance, and the analysis of the market environment. After that follows the estimation and forecasting of future performance. In order to perform the calculation of the discounted cash flows it is necessary to determine also the costs of equity and other parameters (Schacht & Fackler, 2009). The analysis of the target company will not be discussed anymore on this point, as this has been done already in the chapter of the multiples approach.

5.1.1 Analyzing historical performance

Integral part of a proper company valuation is an analysis of the historical performance to create a sustainable basis for the determination of the future success. The analysis of the balance sheet and the income statements is usually done for at least the last three years and includes the following activities (Koller et al., 2005):

1. Reorganize the accounting statements

The accounting statement must be reorganized to separate operating performance from non-operating items and the financing obtained to support the business. As a result the measures ROIC and FCF are independent of leverage and focus solely on the operating performance.

2. Analyzing returns on invested capital

Measure and analyze the company's return on invested capital (ROIC) to evaluate it's ability to create value. As the valuation is only focusing on the company's operations ROIC is a better analytical tool for understanding the company's performance than return on equity (ROE) or return on assets (ROA).

3. Analyzing revenue growth

With the analysis of historical revenue growth the potential of further growth in future can be assess. But in certain cases the calculation of the revenue growth directly from the income statement can be misleading as effects of changes in currency values for multinationals, mergers and acquisitions, and changes in accounting policies can have effects on the results. These effects should also be excluded or adjusted for the whole period under review.

4. Analyzing financial health and capital structure

The last step is to assess the capital structure, its sustainability, and if the company could survive an industry downturn. Therefore the liquidity (the company's ability to meet short-term obligations) and the leverage (the company's ability to meet long-term obligations) are measured, as well as the company's ability to make investments.

5.1.2 Forecasting performance

The forecast of the future performance is done on basis of the analyzed historical performance. The goal is to develop a complete integrated financial planning that includes a balance sheet, an income statement, a cash flow statement, as well as an investment plan. The forecast period is split into a detailed planning period of usually three to five years depending on the specific situation of the company, and a simplified planning period for the time after that is usually considered as a perpetual annuity (Kuhner & Maltry, 2006).

It is also essential to analyze the influence factors of the company and to create planning premises. These are on the one hand assumptions about the global environment such as the development of the economy at all, but also demographic, political, and technical developments. On the other hand these are market and company

specific assumptions, which include the development of demand and a competitor analysis (Kranebitter, 2007).

In case raw materials with heavily fluctuating prices (e.g. oil, aluminum, or steel) are used it is recommended to plan the future material expenditure on basis of different procurement prices. Also planned future actions such as reorganization, personnel layoff, cost-cutting programs and their effects on the profit need to be considered (Drukarczyk & Schüler, 2009).

The forecasting process can be split into the following five steps (Koller et al., 2005):

1. *Analyze historical financials*

2. *Build the revenue forecast*
Estimation of future revenue can be done either top-down (market-based) or bottom-up (customer-based).

3. *Forecast the income statement*
Forecast of operating expenses, depreciation, interest income, interest expense, and reported taxes based on appropriate economic drivers.

4. *Forecast the balance sheet*
Forecasting of operating working capital; net property, plant, and equipment; goodwill; and non-operating assets. Calculate retained earnings and forecast other equity accounts.

5. *Calculation of ROIC and FCF*
Calculate ROIC to assure the forecasts are consistent with economic principles and industry dynamics. Calculation of free cash flow as the basis for valuation is the last step.

Usually the financial planning is provided by the management of the valuation object and therefore needs to be checked on plausibility and to find certain inconsistencies or

implausibility from an overall perspective. Methodically this is done in time comparison as well as in industry comparison so called benchmarking. In case the company is already existing for some years also the comparison of the financial planning of previous years and the respective actual development can give some input on the reasonability of the provided financial planning (Kranebitter, 2007).

5.1.3 Estimating terminal value

As explained in the chapter before the projection of every financial statement line item can just be done for the detailed planning period. Therefore, the FCF after the explicit forecasting period has to be calculated in another step. The terminal value (TV) or also called continuing value is the present value of all free cash flows occurring after the detailed planning period (Palepu et al., 2013). The present value of the terminal value is calculated based on the method of the perpetual annuity (Ross et al., 2003).

A thoughtful estimation of the terminal value is important for any valuation as the terminal value often accounts for a high proportion of the total value of the company. This does not mean that most of the company's value will be created after the detailed planning period but the investments done in the early years yield profits and therefore higher cash flows in the later years (Koller et al., 2005).

Starting point for the calculation of the terminal value is the normalized free cash flow that complies with the FCF of a company in the steady state. In practice, however, usually the FCF from the last year of the detailed planning period is taken as the normalized FCF (Ernst et al., 2010).

The calculation of the terminal value is shown in (37), and in case a positive growth rate (g) is assumed the TV is calculated as in (38) (Nowak, 2003):

$$TV = \frac{FCF_{T+1}}{k_{WACC}} \frac{1}{(1 + k_{WACC})^T} \tag{37}$$

$$TV = \frac{FCF_{T+1}}{k_{WACC} - g} \frac{1}{(1 + k_{WACC})^T} \tag{38}$$

5.2 Estimation of equity costs

The calculation of the equity costs (k_E) in practice is based on the capital assets pricing model (CAPM) therefore the base interest rate (i_r), the market risk premium (mrp), and the beta-factor (β) need to be determined for the valuation object (Mandl & Rabel, 1997). The connection of the three factors is shown in (39):

$$k_E = i_r + mrp * \beta \tag{39}$$

5.2.1 Base interest rate

In the ideal case the base interest rate (i_r) would be equal to the return of an investment portfolio without any default risk and no correlation to the return of any other capital investment. Since such an investment does not exist on the market, the best alternative that fulfills these requirements is taken and this would be the return of government bonds with the highest credit rating.
As these returns are reflecting the expectations of investors regarding the development of the interest rate level and the inflation, the base interest rate can be determined as forward-looking (Aschauer & Purtscher, 2011).

For the purpose of company valuation the return of zero-coupon bonds is considered. The interest payment of this bonds happens just ones at the end of their period, and this return is called spot rate (Diedrich & Dierkes, 2015).

Each cash flow should be discounted with a base interest rate that has a similar maturity, as in principal it can be said that as longer the period of an investment the higher is its interest rate. The term structure of interest rates can be derived from the yield curve. Depending on the circumstances the course of the yield curve can be steeper or flatter and in special cases also declining, what is then called an inverse yield curve (Dörschell, Franken, & Schulte, 2009).

Usually there are not enough zero-coupon bonds available on the market to outline the complete yield curve. Therefore certain approximation methods have been developed

were the method according to Svensson (1994) is the most common one in practice, and its formula is shown in (40):

$$i_r(t,\beta,\tau) = \beta_0 + \beta_1\left(\frac{1-e^{-t/\tau_1}}{t/\tau_1}\right) + \beta_2\left(\frac{1-e^{-t/\tau_1}}{t/\tau_1} - e^{-t/\tau_1}\right) + \beta_3\left(\frac{1-e^{-t/\tau_2}}{t/\tau_2} - e^{-t/\tau_2}\right) \quad (40)$$

$i_r(t,\beta,\tau)$ indicates the spot rate for the period t, and β_0, β_1, β_2, τ_1, and τ_2 are the parameters to determinate the maturity specific spot rate. These parameters are published every trading day from the German Bundesbank for the German capital market and can be accessed via the Internet. The European Central Bank and the Federal Reserve System are publishing the parameters for the yield curve of the European or the US capital market respectively (Diedrich & Dierkes, 2015).

In practice, most people choose a single yield to maturity instead of discounting each cash flow using a matched maturity. For U.S. based valuations typically the 10-year U.S. government bond and for the valuation of European companies the 10-year German Eurobond would be considered (Koller et al., 2005).

5.2.2 Market risk premium

The market risk premium (mrp) can be defined as the difference of the market return and the risk-free base interest rate. In other words, it is the risk premium that an investor is expecting when investing in the market portfolio for the take over of the risks (Drukarczyk & Schüler, 2009).

The determination of the market risk premium is one of the most debated topics in finance and there is still no consistent opinion about the concepts and parameters (Ballwieser, 2011; Koller et al., 2005; Mandl & Rabel, 1997). Basically the estimation could be done on basis of historical market risk premiums (Kruschwitz et al., 2009), on basis of expert surveys (Fernandez & Del Campo Baonza, 2010), or on basis of implicit market risk premiums (Damodaran, 2006).

However, the most popular approach is the assessment on basis of historical market risk premiums. The assumption of this approach is that market risk premiums are not or

only insignificantly changing in course of time and therefore the observations of the past can be carried forward into the future. In practice it is not necessary to estimate the market risk premium for each valuation but existing studies can be used. But it has to be considered that the basis is the same that is also used for the base interest rate and the beta factor (Diedrich & Dierkes, 2015).

Prior to the financial crisis the appropriate market risk premium has been between 4,5% and 5,5%, based on historical averages and forward-looking estimations (IDW, 2009; Mandl & Rabel, 1997; Koller et al., 2005). The government debt crisis has lead to a significant reduction of the base interest rate and this would lead to mathematical higher company values. Therefore, a market risk premium derived from historical data would not reflect the current situation. According to the expert opinion of the Austrian and as well the German auditors an appropriate market risk premium is currently between 5,5% and 7,0% (IDW, 2012; Raml, 2013).

5.2.3 Beta factor

The specific risk premium for an investment is based on the amount of systematic risk that is taken over by the defined investment. The measure of the systematic risk is the beta factor. The beta factor (β_j) is putting the valuation relevant security-specific risk in relationship with the market risk and measures its sensitivity to the market. Values of the beta higher (lower) then 1 are signaling a higher (lower) risk of the security compared to the market risk (Drukarczyk & Schüler, 2009).

The determination of the beta for stock exchange listed companies is done in practice with linear regression of past earnings per share of the company and the market return. The beta is the ratio of the covariance of the security's return with the return of the market portfolio to the variance of the market portfolio's return (Ballwieser & Hachmeister, 2013).

As the compilation of the theoretical market portfolio that would include all possible risky investment opportunities is rather difficult, in practice, a stock index is used as market portfolio instead (Baetge, Niemeyer, & Kümmel, 2005). Usually in the most countries or at stock exchanges are more indexes calculated. This leads to the question

if a wide (if possible with all traded securities of the market) or a solvent (preferably high trading activities) country index should be selected. The recommendation is to take the more solvent index, as it can be assumed that the companies' actual prospects are reflected more accurate in frequently traded securities (Aschauer & Purtscher, 2011).

Analysts most commonly use the S&P 500 for U.S. stocks, the MSCI Europe Index for European stock, or the MSCI World Index. It is not recommended to use a local market index as most countries are heavily weighted in only a few industries and in certain cases just a few companies. Consequently, market wide systematic risk would not be measured accurately (Koller et al., 2005).

In principal, the beta is a forward-looking factor that means the systematic risk of the future is assumed. The determination is done normally by analyzing historical data under the assumption that they are representative for the future. There is no common standard for the appropriate measurement period, but for the purpose of a statistical correct outcome a sample of 50 to 60 pairs of values is needed. Commonly, either the monthly data of the past five years or the weekly data of the past two years is used to determine the beta (Diedrich & Dierkes, 2015).

An alternative to the regression is the usage of data provided by financial service providers, such as Bloomberg, Reuters, etc. (Ernst et al., 2010). It has to be considered that the selection of the reference index, the frequency of the calculation, and the time interval can have a severe influence on the results (Schacht & Fackler, 2009).

Based on the previous explanations it is clear that a company has to be listed on a stock exchange to calculate its beta, as for an unlisted company the necessary information of the return is not available (Dörschell et al., 2009). In the case of an unlisted company or if the individual beta is not meaningful, the beta factor of a peer group of companies or of an industry would be applied instead (KFS/BW1, 2014).

The beta as a measure of the systematic risk is including the business risk (i.e. operating beta) and the risk from the capital structure (i.e. financial beta). Whereas the operating beta is mainly influenced buy the industry of the company, the financial beta

is dependent on the financing structure of the company and is the higher, the higher the debt ratio is (Aschauer & Purtscher, 2011).

The beta factor for a leveraged company is therefore higher as the beta factor for an unlevered company, as also the risk from the capital structure is considered (KFS/BW1, 2014). However, the future financing structure of the valuation object does not have to correspond with the financing structure of the history or with the financing structure of the peer group or the industry average. Therefore, the operating risk has to be considered isolated from the financing risk (Diedrich & Dierkes, 2015).

To identify the operating beta of the peer group an unlevered beta (β_U) adjusted for the debt is derived from the levered beta (β_L). The unlevered beta represents the beta factor of a fictitious self-financed company. In the second step the unlevered beta is adjusted to the financing structure of the valuation object (under consideration of the tax situation) that results in the relevered beta (Seppelfricke, 2005).

The relation of levered and unlevered beta is shown in (41). The first part of the formula represents the operative beta and the second after the plus the financial beta. In case of no debt, the total systematic risk is the operative risk. Whereas the higher the debt ratio, the higher also the financial risk and therefore the total systematic risk (Dörschell et al., 2009):

$$\beta_L = \beta_U + \beta_U * (1 - T_m) * \frac{D}{E} \tag{41}$$

In formula (41) it is assumed that the total risk of the capital structure is borne by the equity providers. If however, the cost of debt is not equal to the risk free interest rate because outside creditors also bear some risk, the financial beta is reduced by this amount (42), which is called debt beta (β_D) (43) (KPMG, 2014):

$$\beta_L = \beta_U + (\beta_U - \beta_D) * (1 - T_m) * \frac{D}{E} \tag{42}$$

The debt beta is a ratio of the risk premium required by the outside creditors, the so-called credit spread, and the market risk premium (Schacht & Fackler, 2009).

$$\beta_D = \frac{k_D - i_r}{mrp} \tag{43}$$

For companies with a good credit rating it can be assumed that the debt beta is close to zero and therefore can be neglected in practice. But in other cases a negligence of the debt beta would lead to an overestimation of the cost of equity and therefore to an underestimation of the company value (Mandl & Rabel, 1997).

Formula (42) is based on the assumption of a constant debt capital and therefore discounted with the costs of debt. In the situation of a value-based financing policy the amount of debt is changing proportionally to the company value, so the realization of the tax shields is risky and accordingly the tax shields are discounted by with the costs of equity. Consequently formal (44) is applied in such cases instead of (42) (Pratt & Grabowski, 2008).

$$\beta_L = \beta_U + (\beta_U - \beta_D) * \frac{D}{E} \tag{44}$$

5.3 Estimation of further parameters

5.3.1 Cost of debt

For the estimation of the cost of debt it is of importance to determine the interest rate that has to be paid under the current market situation for the borrowing of funds at a comparable risk. The cost of debt that have been paid in the past are not relevant in this situation, but are often used as a reference in practice in case the company is able to refinance under similar conditions (Schacht & Fackler, 2009).

It is necessary to differentiate between interest bearing debt and non-interest bearing debt as only the first on is considered in the valuation. Non-interest bearing debt, such as supplier credits or accruals, is usually included in the operating result. Interest

bearing debt is in particular bonds, bank loans, credits, and leasing financing (Mandl & Rabel, 1997).

Beside the credit terms (e.g. time) and the current market situation are the cost of debt mainly determined trough the creditworthiness of the valuation object. The creditworthiness is expressed with a rating that reflects the expert opinion of rating agencies, credit agencies, or banks about the company's ability to fulfill its payment obligations in the future (Ostermann, 2004).

5.3.2 Determining the capital structure

For the calculation of the relevered beta but also for the weighted average costs of capital in the WACC-approach the future capital or financing structure (market value of equity and debt) has to be known, in comparison to the APV-approach where the amount of debt is planned and therefore this problem does not exist (Aschauer & Purtscher, 2011).

The market value of interest bearing debt is normally known at the valuation date or can be estimated at book values (KFS/BW1, 2014). But for the estimation of the market value of equity exists a circularity problem, as already discussed earlier. Three approaches have been developed to solve this problem in practice (Drukarczyk & Schüler, 2009).

The first solution would be the determination of a future target capital structure on basis of market values, whereby the capital structure of a peer group is taken as a reference. This approach follows the assumption that there is an industry specific optimal capital structure. And immediately after the company's acquisition the capital structure would be adapted to this target structure by the investor (Koller et al., 2005).

The second possibility would be a solution by mathematical iteration. Therefore the equity and debt are taken at book values in the initial steps and a capitalization interest rate and a company value (=market value of equity) are calculated. The new equity value is then taken to calculate the interest rate and the company value again. This is done until a solution is found (Mandl & Rabel, 1997).

The third option is the application of an autonomous financing policy, where the amount of debt is determined constant for the whole planning and valuation period. But a change of the cash flows in the planning period would lead to different values of the total capital from period to period. This can be solved for the detailed planning period with an iterative roll-back approach and a constant cash flow in the phase of perpetual annuity (Schwetzler & Darijtschuk, 1998).

5.3.3 Non-operating capital

In the calculation of the free cash flows in the DCF-approach the non-operating assets have been excluded. But for the calculation of the entire company value also this assets have to be considered as they also bear some value. As these assets are not relevant for the operational business they can be fed to an alternative utilization concept (normally liquidation) without influencing the business.
For the valuation the higher value of either the liquidation value (under consideration of selling expenses and duration) or the continuing value (present value of future cash flows) is applied (Aschauer & Purtscher, 2011).

5.4 Conclusion

The significance of the results of a company valuation built up on an in-depth analysis of the valuation object and its environment (Kranebitter, 2007). An integral part of a proper company valuation is an analysis of the historical performance to create a sustainable basis for the determination of the future success (Schacht & Fackler, 2009).

The forecast of the future performance is done on basis of the analyzed historical performance. The goal is to develop a complete integrated financial planning for the detailed planning period of usually three to five years and a simplified planning period for the time after (Kuhner & Maltry, 2006).

A thoughtful estimation of the terminal value is important for any valuation as the terminal value often accounts for a high proportion of the total value of a company (Koller et al., 2005). The calculation of the equity costs in practice is based on the

capital assets pricing model (CAPM) that consists of the base interest rate, the market risk premium, and the beta-factor (Mandl & Rabel, 1997).

6 Summary and outlook

6.1 Summary

The topic company valuation is one of the most significant areas of business administration but also one of the most controversial (Ballwieser, 2011; Mandl & Rabel, 1997). The reasons why the subject of company valuation is facing high attention in both science and practice are on the one hand the increasing number of company transactions and their extend (Kuhner & Maltry, 2006) and on the other hand also the discussion about value-based management has given a strong impulse to the field of company valuation (Drukarczyk & Schüler, 2009).

The occasions for a company valuation can be typically grouped in the lifecycle of a company, that are foundation, expansion, running business, restructuring, and liquidation (Drukarczyk & Schüler, 2009; Kranebitter, 2007). For all this occasions the goal is always to define a decision value, an arbitration value, or an objective company value (Bertl et al., 2010).

The methods of company valuation can be classified in three basic groups depending if they are focusing only on the values of the single components of the company, the company as one unit that is a compositions of its assets, or on something in between (Ernst et al., 2010).

The single valuation approach is calculating the net asset value of a company, which is the sum of the values of its single assets minus the value of its liabilities. The net asset value can be calculated under the assumption of continuation or liquidation of the company (Mandl & Rabel, 1997). Mixed valuation approaches can be considered as advancement of single valuation approaches and include beside the net asset value also the earning power of a company (Kuhner & Maltry, 2006).

The total valuation approaches consider a company as a valuation object in total and not as a sum of its single assets. Total valuation approaches can be divided in two categories, the income approaches determine the value by calculating the net present value of future cash-flows generated by the business, and the market approaches that

determine the value by comparing the object company to the market price of other companies (Heesen, 2014).

The group of income approaches can be divided into the discounted cash flow (DCF) approach and the earnings value method, which are both based on the net present value method, i.e. evaluate the future cash flow of a company at a specific date (Aschauer & Purtscher, 2011). As in practice a strong convergence between this two methods can be noticed and also due to the stronger influence of Anglo-American valuation methods, it can be said that only the discounted cash flow approach has practical relevance (Ernst et al., 2010).

Under the discounted cash flow method there exist three approaches, the WACC- (weighted average cost of capital), the APV- (adjusted present value), and the FtE- (flow to equity) approach (Jäger, 2013).

The market approaches are using the known market price of other companies to calculate multiples that are then taken to valuate the object company. There is the possibility to either taking the market prices of stock exchange listed companies (comparable companies approach) or using the market prices of recently acquired comparable companies (comparable transaction approach) (Kranebitter, 2007). The most important point when applying these methods is the selection of appropriate comparable companies with similar prospects (Koller et al., 2005).

6.2 Answer of research questions

After the summary given about the variety of company valuation existing should follow at this point the answer of the research questions.

Research question 1: Which valuation methods have the most practical relevance in the economy?

The most common method used internationally and also the most practical relevance has the discounted cash flow method with its three approaches. But typically not only

one method is used but a combination of the DCF method and the multiple-based approach to validate the results is applied (DVFA, 2012). Also according to the expert opinion of the "Austrian Chamber of Public Accountants and Tax Advisers for the Valuation of Businesses", the future profit value of a business should be determined under the usage of the discounted cash flow method and additionally a plausibility check has to be performed by using a multiples method (KFS/BW1, 2014).

Research question 2: How are these methods applied in detail?

The individual variants of the DCF-method distinguish themselves basically in the manner of calculating the shareholder value directly (equity approach) or indirectly (entity approach), and how the tax advantage due to debt financing (tax shield) is used (Spremann & Ernst, 2011). The aim of all approaches is to determine the market value of the company respectively its equity (Ballwieser, 2011) and therefore estimating the present value (PV) of a company by discounting future payments, the free cash flows (Jäger, 2013).

In order to determine the FCF of a company it is necessary to analyze the valuation object, it's historical performance, and the market environment (Schacht & Fackler, 2009). Integral part of a proper company valuation is an analysis of the historical performance to create a sustainable basis for the determination of the future success (Koller et al., 2005).

After that follows the estimation and forecasting of future performance. The goal is to develop a complete integrated financial planning that includes a balance sheet, an income statement, a cash flow statement, as well as an investment plan (Kuhner & Maltry, 2006).

It is also essential to analyze the influence factors of the company and to create planning premises. These are assumptions about the development of the economy at all, but also market and company specific assumptions, which include the development of demand and a competitor analysis (Kranebitter, 2007).

The free cash flows are calculated based on the assumption of a company financed entirely with equity, providing the advantage that the operating performance can be compared without regard to the capital structure (Koller et al., 2005).

The WACC-approach is calculating the company value by discounting the free cash flow with the weighted average costs of capital and afterwards subtracting the market value of debt (Kruschwitz et al., 2009). In contrast, the APV-model separates the value of a company in three parts: the value of operations as if the company were all equity financed, the value of tax shields arising from debt financing, and the value of debt (Ballwieser, 2011). The flow to equity model values equity directly by discounting cash flows to equity at the cost of equity rather than at the weighted average cost of capital (Koller et al., 2005).

In order to perform the calculation of the discounted cash flows it is necessary to determine the costs of equity and the costs of debt (Schacht & Fackler, 2009). The calculation of the equity costs in practice is based on the capital assets pricing model that consists of the base interest rate, the market risk premium, and the beta factor of the valuation object (Mandl & Rabel, 1997).

In practice, as the base interest rate the rate of return of government bonds with the highest credit rating is considered (Aschauer & Purtscher, 2011). The market risk premium is the amount that an investor is expecting when investing in the market portfolio for the take over of the risks (Drukarczyk & Schüler, 2009). It is not necessary to estimate the market risk premium for each valuation because existing studies can be used (Diedrich & Dierkes, 2015).

The measure of the systematic risk that is taken over with a specific investment is the beta factor (Drukarczyk & Schüler, 2009). The determination of the beta for stock exchange listed companies is done in practice with linear regression of past earnings per share of the company and the market return (Ballwieser & Hachmeister, 2013) or data provided by financial service providers, such as Bloomberg, Reuters, etc. is used (Ernst et al., 2010).

For the estimation of the cost of debt it is of importance to determine the interest rate that has to be paid under the current market situation for the borrowing of funds at a comparable risk (Schacht & Fackler, 2009).

It is recommended to check the plausibility of the results of a DCF calculation with the application of a multiple valuation method (KFS/BW1, 2014). In a first step a multiple is calculated as a ratio of the (known) market value of a comparable company and a reference of its financial performance. In a second step the reference factor of the company to be valued is multiplied with the multiple to calculate the potential market price (Wagner, 2005).

For the selection of comparable companies or transactions it is important that they share the same characteristics as the valuation object and that includes the sector or industry, the business model, the size of the company, its growth profile, and its profitability (Wagner, 2005).

The in practice used multiples can be distinguished in enterprise-value- and equity-value-multiples. The first ones are defined as enterprise value divided by sales, EBITDA, EBIT, or an operative factor. The second ones are defined as equity value divided by net profit, cash flow, or book value of equity (KPMG, 2014).

The calculated multiples of each comparable company need to be compress to one “representative” multiple for the target company as otherwise the results would lead to a very large range of estimations of the equity value. Usually the calculation is not done with one single multiples but instead with several multiples and the results are shown in a range (Aschauer & Purtscher, 2011).

6.3 Outlook

In the last years the increasing importance of start-up companies for an economy could have been observed. These companies are providing more and more jobs but an even more important aspect is the creation of innovations and the development of new products and services (Ripsas & Tröger, 2014). This is the reason why more and more

large corporations of established industries are focusing on start-up for the creation and development of new ideas and innovations (Steininger et al., 2014).

Therefore, certain start-ups could be interesting acquisition targets for large corporations and consequently a company valuation to define an appropriate purchase price for these companies would need to be performed in such cases. The question then immediately arises: What are the differences in the valuation of start-ups and high growth companies in comparison to established companies? In the context of company valuation it is of high interest to find an answer for this question.

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