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The Metzler Valuation Guide

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For valuating financial instruments, Metzler Research uses standard and widely accepted methods of fundamental analysis such as DCF analysis, peer group analysis, sum-of-the-parts analysis or relative value analysis. Quantitative and technical analyses can also be included in the evaluation as well as intermarket analysis and behavioral finance approaches. The Metzler Valuation Guide describes the valuation principles and methods applied by Metzler Research.

- Discounted Cash Flow Model

- Dividend Discount Model

- Peer group analysis

- Sum-of-the-parts analysis

- Intermarket analysis

- Relative value analysis

- Technical analysis

- Behavioral finance

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Contents

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Discounted Cash Flow Model

Since we consider the Discounted Cash Flow Model to be the most basic and most wide-spread valuation tool around, all fundamentals also relevant for the other models will be explained in this chapter, e.g. Capital Asset Pricing Model (CAPM) or cost of equity (COE).

Discounted Cash Flow, WACC, CAPM, COE

The DCF valuation method

With our Discounted Cash Flow (DCF) valuation method we derive the enterprise value after taking into account a company's long-term cash flows after investments used in order to generate this cash. These cash flows are then discounted to their present value (i.e. what they should be worth today) by the capital's hurdle rate – the minimum return required by investors for taking the risk of financing a company's business activities. Think of this as what you would want to get paid for taking money out of your pocket and giving it to someone to do with it what he wants for several years. Logically, the riskier the business into which the company is investing, the higher the return an investor will require.

In this, the DCF Model differs from so-called accounting valuation methods such as price/earnings, enterprise value/sales, EBITDA, EBIT, price/book, PEG, etc. which only deal with the current earnings of a company or its earnings during a limited future time horizon – and not with the means by which a company finances its growth or the riskiness of its business.

Definition of cash flow and free cash flow

Cash flow, the latter two words of the term Discounted Cash Flow, designates financial cash flow which is not the same as that given in the company's financial statement. The relevant cash flow is free cash flow and it is, theoretically, the cash that is generated by investing in the business and which is available to be distributed to all contributors of capital, i.e. debt and equity investors.

Free cash flow is calculated as follows:

Operating profit (EBIT)
-	Taxes on EBIT
=	Net operating profit after taxes (NOPAT)
+	Depreciation of fixed assets
+	Amortisation of goodwill
=	Gross cash flow
-	Capital expenditure (capex)
-	Increase in working capital (WC)
=	**Free cash flow**

EBIT is the starting point of free cash flow because, as it is before interest expense, it is the profit that is available to both debt and equity

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Capital Markets

investors. We then tax EBIT at our company's **effective tax rate**, because the tax man always gets his due before the equity investor. Taxing EBIT also removes the tax shield involved in debt financing, i.e. we make the advantages given to financing one way or the other, debt or equity, irrelevant.

After adding back the non-cash charges of **depreciation of fixed assets and amortisation of goodwill**, we come to our **gross cash flow** number, which is not yet **free**, because the cost of producing cash flow generation is not free and someone has to pay for it. This payment is encapsulated in the terms **capital expenditure**, or **capex**, and **working capital**. Capital expenditure is the money invested in fixed assets such as equipment and buildings, etc. **Working capital** (WC) is the cash investment needed to run a company's daily business and it varies according to industry and seasonality. To derive WC, we add together the current assets of accounts receivable and inventories and subtract the current liability of accounts payable. Then, when we have subtracted capex and WC from gross cash flow, we have free cash flow.

Discounting the cash flow

In a second step we have a closer look at the word **discounted in DCF**. As stated above, the DCF method helps to value a company based on its long-term cash flows. Therefore, we predict streams of free cash flows, not just for the next few years, but for the entire life of the company. In the DCF method, this is modeled by calculating free cash flows for a **forecast period**, at Metzler seven years, and then combining the rest of the company's free cash flow into a period called the **terminal value** (also called "**residual value**").

Does the length of the forecast period matter? Yes and no. Usually the number of years chosen are determined by what the analyst thinks is the company's competitive advantage period (CAP) or the period of time during which the company can generate returns substantially above its cost of capital (i.e. the company is in a high-growth phase) before the company comes to a period of "normalized" growth at the end of the forecast period. Normalized growth occurs when the company has reached a point of equilibrium, i.e. it slows down, as it has grown strong enough for its base effect growth rate to be largely irrelevant and/or new competition in the industry has driven down the velocity at which the company can grow after the forecast period.

Close care and attention must be paid to the terminal value because of its consider-able weight in determining the enterprise value. The terminal value is the guiding force behind the resulting valuation of a DCF analysis as it sometimes makes up to 90% of the entire enterprise value calculated. Therefore, for all intensive purposes the length of the forecast period is of minor importance.

Guide

WACC – the Weighted Average Cost of Capital

The free cash flows we have determined for the forecast period are discounted by a rate called the **Weighted Average Cost of Capital (WACC)** – and by using the present value (PV) formula as follows.

$$DCF\,(\text{i.e. PV of free cash flow}) = \frac{FCF}{(1+WACC)^N} \text{, whereby}$$

FCF = Free cash flow
WACC = Weighted Average Cost of Capital
N = Periodicity or time period.

CAPM – Capital Asset Pricing Model

By using the WACC we take into account the capital structure of the company, its cost, and the riskiness of the investment of capital in the company. The theory behind the WACC comes from the so-called **Capital Asset Pricing Model (CAPM)**. According to Barron's Dictionary of Finance and Investment Terms, CAPM is "a sophisticated model of the relationship between expected risk and expected return. The model is grounded in the theory that investors demand higher returns for higher risks". Further "the CAPM postulates that the opportunity cost of equity is equal to the return on risk-free securities, plus the company's systematic risk (Beta or "ß"), multiplied by the market price of risk (market risk premium);" states Tom Copeland in **"Valuation: Measuring and Managing the Value of Companies"**.

COE – cost of equity

Hence the cost of equity equation (K_e) according to CAPM is:

$K_e = R_f + (R_m - R_f) \times ß$, whereby

R_f = Risk-free rate of return
$R_m - R_f$ = Equity market risk premium
ß = Beta or the systematic risk of the equity.

But the CAPM is not a complete equation for our purposes as we must also take into account the debt used by the companies to finance their activities. Therefore, to construct WACC, we also tack on an equation which enables us to calculate the cost of debt (K_d):

K_d = Yield to maturity on long-term financial debt x (1 - effective tax rate)

To tie it all together, we weight the two equations with the proportion of debt and equity in the company's capital structure:

$$\text{For debt}: \quad \frac{D}{D+E}$$

$$\text{For equity}: \quad \frac{E}{D+E} \text{, whereby}$$

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D   =   Book value of all interest-bearing i.e. financial debt (a good approximation for market value, plus easy to get)

E   =   Market value of equity, i.e. total shares outstanding x current share price.

Thus, the Weighted Average Cost of Capital is:

$$\text{WACC} = \frac{D}{D+E} * K_d + \frac{E}{D+E} * K_e$$

The WACC equation is not a complicated one, but the inputs are the tricky part. The input for the Beta is the most complicated. As the other inputs are relatively straight-forward, we will cover them quickly before moving on to Beta.

The risk-free rate of return and the market risk premium

In addition to Beta, the cost of equity (K_e) has two other inputs: the risk-free rate of return (R_f) and the equity market risk premium (R_m-R_f). With the risk-free rate of return we approximate the return an investor expects to receive simply for the fact that he is giving his money to invest in a security versus keeping it in cash or spending it (i.e. opportunity cost). Theoretically, the decision is made without regard to risk. This means that if you invest in a risk-free security, you would, theoretically, have a 100% chance of getting back all interest and principle due to you by the end of the investment period. To model this, we usually use the historical interest rate on long-term government securities in the market in which the company is traded (risk-free rate).

To take into account that a portion of share-price risk is related to general stock market sentiment and patterns, we use the equity market risk premium or R_m- R_f – the historical difference between total stock market return and total bond yields on long-term government securities.

For the cost of debt (K_d), we have just two inputs: the yield to maturity and the company's effective tax rate. For the yield to maturity on long-term debt, we can either ask the company for the average interest rate it pays on such debt or have a look at the company's annual report. Then, we calculate the after-tax cost of this debt by multiplying the interest rate by one minus the company's effective tax rate. We use an average effective tax rate, if the current year is one in which the tax rate differs from what is normal for the company.

Beta – definition and how to find it

With the Beta we measure the systematic risk of a particular stock in relation to the market in which it is traded. Assuming that the number 1.0 stands for the stock market and its movements, a Beta of 1.5 would mean a stock that is riskier, or its price moves 50% more than the stock market itself, when it shifts. A Beta lower than 1.0 would mean a stock

that is less risky than the stock market in that it moves half as much as the stock market itself.

How do we find Betas? Essentially there are three different methods:

■ **Bloomberg Beta.** After calling up the company's ticker, typing BETA and pressing GO, there will be a Beta and a chart there. We use "adjusted Beta". The more dots the better, meaning there are more data points for Bloomberg to measure Beta. If the company has a long trading history, i.e. longer than five years, we use the Bloomberg Beta. If not, then we proceed to the second and third methods of getting Beta.

■ **Calculate own Beta in Excel using a peer group.** We need the following information from the peers:

– **Betas:** we get these either from Bloomberg or Value Line.

– **Capital structure:** i.e. the book value of financial debt (D) and the market value of the individual peer's equity (E) – we already have this because we use it to calculate the peers' enterprise value.

– **Effective tax rate (T):** the easiest way to get this is to first have a look at Value Line (fine for U.S. and major foreign companies with ADRs). Otherwise we go for the company's annual report.

■ **Appropriate the Beta from another company and apply it to the analyzed one.** We would term this the riskiest way of deriving Beta based upon what we said above about capital structure, etc. This procedure is particularly risky when comparing companies with different histories and sizes (usually larger companies are more stable).

Betas reflect the riskiness of a company's business in tandem with how these activities are financed (i.e. capital structure). Therefore, in order to make the Betas as comparable as possible, we strip out the debt in the peer company's capital structure – or **unlever** the Beta – in order to get to the underlying equity Beta. Then we take the peer group average of equity Betas and **relever** this to reflect our company's capital structure.

We use the following formula to unlever the Beta in a first step:

$$\text{Unlevered } \beta = \frac{\text{Levered } \beta}{1 + [(1 - T) * (D/E)]}$$

In a second step, we relever the peer group average equity Beta to fit the company's capital structure:

$$\text{Levered } \beta = \text{Unlevered } \beta * [1 + (1 - T) * (D/E)] \text{, whereby}$$

T	=	Tax rate
D	=	Debt
E	=	Equity.

The terminal value

The **terminal value (TV)** determines, as mentioned before, a big chunk of the enterprise value calculated with the DCF method. It is calculated by giving inputs for the last year **(terminal year)** in the DCF model that we believe are sustainable for the continuing life of the company and then by discounting this to the present by a special formula.

As we said above, the TV inputs must reflect what we believe to be a sustainable level of growth for the company. The usual method is to assume that the company will face competition from others which will result in a slower growth rate and lower operating profit margin than in the forecast period. This means that the TV numbers should also be lower than in the forecast period. Further, if we assume that the company's business slows down, we must also assume that the company will invest less cash in its operations. Hence, we need to reduce the TV investment in both capex and working capital to reflect this. Copeland says that this is the most frequent mistake made with calculating TV.

The ultimate FCF originating from this terminal year is discounted using the TV **with perpetuity** formula – assuming that after the forecast period the company's FCF will continue to grow at a constant rate and the company will "earn constant margins, (and maintain) a constant capital turnover" as Copeland says. There are other methods that are used to determine the TV; however, this is the one most commonly used by equity analysts.

The terminal value with perpetuity formula is:

$$TV = \frac{FCF_{N+1}}{WACC - G} \text{ , whereby}$$

FCF_{N+1} =		FCF in the year after the forecast period (i.e. year 8)
WACC =		Weighted Average Cost of Capital
G =		Assumed rate at which most companies will grow in the long term. We define this as long-term GDP plus inflation expectations – numbers which will change periodically and will be updated in MESCOR.

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Dividend Discount Model

In a classic Dividend Discount Model (DDM) the value of the company, i.e. the value of a company's equity, P, is derived by discounting all (expected) future dividends at the required rate of return for the equity investors.

The theory: A variety of Dividend Discount Models

The classic DDM

Formally, this can be stated as follows:

$$P = \sum_{t=1}^{\infty} \frac{D_t}{(1+i)^t} \text{ , whereby}$$

P   =   Value of a company
D_t =   Dividend in period t
i   =   Required rate of return for the equity investor.

The required rate of return for the equity investor is also known as the cost of equity, COE, which represents the investor's opportunity cost, i.e. the return of the best alternative investment (adjusted for risk). By assuming

■ a constant dividend for all periods or

■ a constant growth rate for dividends (Gordon Growth Model) or

■ a different growth rate for dividends (Three Phase Model), one gets a variety of DDMs which will be discussed in more detail in the following sections.

The DDM with constant dividends

If the COE is assumed to be constant over time and one also presumes an unchanged dividend, $D_t = D$, for all future periods, t, the concept of perpetuity bonds applies, i.e.

$$P = \sum_{t=1}^{\infty} \frac{D_t}{(1+COE)^t} \text{ , with } D_t = D = const.$$

$$P = D * \sum_{t=1}^{\infty} \frac{1}{(1+COE)^t}$$

$$P = D * \frac{1}{(1+COE)-1} = \frac{D}{COE} \text{ , whereby}$$

P   =   Value of a company
D_t =   Dividend in period t

COE   =   Cost of equity.

The Gordon Growth Model

If, in contrast, the dividends paid are assumed to grow at a constant rate, g, i.e. $D_t = (1 + g) * D_{(t-1)}$, the so called Gordon Growth Model (GGM) is suitable:

$$P = \sum_{t=1}^{\infty} \frac{D_t}{(1+COE)^t} \text{ , with } D_t = D_{(t-1)} * (1+g)$$

$$P = \sum_{t=0}^{\infty} \frac{D_1 * (1+g)^t}{(1+COE)^{(t+1)}}$$

$$P = \frac{D_1}{(1+COE)} * \sum_{t=0}^{\infty} \left(\frac{(1+g)}{(1+COE)} \right)^t$$

$$P = \frac{D_1}{(1+COE)} * \frac{1}{1 - \frac{1+g}{1+COE}}$$

$$P = \frac{D_1}{(1+COE) - (1+g)}$$

$$P = \frac{D_1}{COE - g} \text{ , whereby}$$

P   =   Value of a company
D_t =   Dividend in period t
COE   =   Cost of equity
g   =   Growth rate.

The Three Phase Model

The Three Phase Model is more flexible than the GGM in that it allows for different growth rates in each phase. For the first three years (first phase) the analyst has to provide detailed dividend estimates. One further assumes that the company reaches a steady state or long-term equilibrium growth rate after eight years. The steady state itself represents the third phase of the model. The second phase (transition phase) lasts from the fourth to the eighth year. During this period, growth rates move towards the long-term equilibrium growth rate. In terms of valuation we have to discount the dividends using the COE. Applying the GGM in the last phase leads to the company's value of equity after the second phase which has to be discounted to present as well.

An alternative to applying the GGM in order to determine the value of the company after the second phase (also known as terminal value) can be shown by exploiting the relationship between growth (g), retention rate

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Capital Markets

(RR) and return on equity (ROE) which is $g = ROE * RR$[1]. To see this, one has to rewrite the last equation of the above GGM as follows:

$$P_8 = \frac{D}{COE - g} \text{ , with } D = return * (1 - RR)$$

$$P_8 = \frac{return * (1 - RR)}{COE - g}$$

$$P_8 = \frac{return - (return * RR)}{COE - g} \text{ , with } return = ROE * equity_8$$

$$P_8 = \frac{(ROE * equity_8) - (ROE * equity_8 * RR)}{COE - g} \text{ , with } ROE * RR = g$$

$$P_8 = \frac{(ROE * equity_8) - (g * equity_8)}{COE - g}$$

$$P_8 = \underbrace{\frac{ROE - g}{COE - g}}_{P/B \text{ multiple}} * equity_8 \text{, whereby}$$

P_8	=	Value of a company after the second phase, i.e. after the eighth year
D	=	Dividend in the first year of the third phase
COE	=	Long-term cost of equity
g	=	Sustainable growth rate
RR	=	Retention rate
ROE	=	Long-term return on equity after taxes
$Equity_8$	=	Long-term equity, i.e. equity at the end of the eighth year.

The fraction on the right-hand side of the last equation is also known as the price to book multiple (P/B multiple).

The ROE/COE Model

It has, however, become industry standard to proxy the results achieved by the Three Phase Model by applying the so called ROE/COE Model which focuses on the substance and capability to generate over-returns by comparing the return on equity (after taxes) to the cost of equity. In this case, the value of the company is determined by using the following formula:

$$P_2 = \frac{ROE - g}{COE - g} * equity_2 \text{, whereby}$$

P_2	=	Fair value of a company's equity two years ahead
COE	=	Long-term cost of equity
g	=	Sustainable growth rate
ROE	=	Long-term return on equity after taxes

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[1] To see this, multiply both sides of the equation by equity. On the right side this leads to an expression (Return * RR) which basically represents the change in the company's equity. On the left side the manipu-lation yields g * Equity which also represents the change in equity. This relationship always holds in the steady state.

$Equity_2$ = Long-term equity, i.e. equity at the end of the second year.

This actually equals the formula for the calculation of the terminal value in the Three Phase Model. In our ROE/COE Model it is assumed that ROE, COE and g attune to their long-term levels after only two years. Using the actual values for ROE and COE would not be reasonable because the latest ROE and COE need not necessarily be the long-term equilibrium. In this case, we get the value of the company's equity by discounting the derived value to present.

Due to the fact that the model starts with the long-term equilibrium (steady state) after the second year, one systematically omits dividends being generated previously to the steady state (in our case the model refers to the book value two years ahead, meaning that the dividends of the first two years are not taken into account). Therefore these terms have to be considered as well.

The ROE/COE Model has an intuitive appealing interpretation which makes it very popular amongst practitioners. From the formula, one can conclude that a company's equity is the more valuable the higher the ROE relative to the COE. In other words a company with COE below ROE is continuously adding value.

Guide

Peer group analysis

Market-oriented multiples method

For analyzing companies, a market-oriented peer group analysis (or multiples method) is often used in addition to the future-success-oriented valuation methods such as the earnings value method or the Discounted Cash Flow method. For the peer group analysis, the enterprise value of a company is derived from the market prices of comparable listed companies, the so-called peer group. The enterprise value is calculated as the product of a multiple derived from comparable companies and the key figure of the company.

Thus, the peer group analysis implicitly assumes that conclusions about enterprise value can be drawn from the observable market prices of comparable companies. For a meaningful evaluation, it is therefore essential to carry out the best-possible comparison of a company with its peer group.

Analysis of main value drivers

There are several steps required for evaluating a company according to the peer group method. The first step is a detailed business analysis to identify the company's main value drivers, e.g. sales growth rate, operating margin or positioning of the company in its respective market.

Based on this evaluation of the company, comparable listed companies are searched out. Such companies are generally active in the same industry, although this does not necessarily have to be the case. In most cases, this search represents the greatest challenge for the analyst because realistically there are no exactly comparable companies. In order to reduce dependency on any single company and thus the potential danger of incorrect valuation, an entire group of comparable companies is usually identified.

Reference figures: sales, EBITDA, EBIT or annual net profit

For deriving and calculating multiples, the most current values are set in relation to the expected reference figures because enterprise value is generally a representation of future values. Reference figures can be sales, EBITDA, EBIT or annual net profit figures. Quantitative data such as the number of customers or website clicks can also be included in the analysis. When using quantitative data, it is important to consider that differences in earning power or in the cost structure of the peer group compared to the company are not taken into consideration.

Equity and entity multiples

There is a fundamental distinction between equity and entity multiples. For equity multiples (e.g. P/E ratio), market value is calculated directly from the product of a multiple from the peer group and a key figure of the company (e.g. expected annual net profit). For entity multiples (e.g. enterprise value/sales, enterprise value/EBITDA or enterprise value/EBIT), market value refers to total capital (enterprise value or EV), in other words market value of equity and debt capital minus cash and cash equivalents. Equity multiples do not take into consideration the fact that equity costs

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vary depending on the debt-equity ratio of the company. Therefore, entity multiples make it easier to compare diversely financed companies.

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Sum-of-the-parts analysis

Dividing the company into individual strategic business units

For the sum-of-the-parts analysis, the company is divided into individual strategic business units. Each business unit is seen as a small, autonomous company and is evaluated separately. This division takes place because the development of the individual business units is viewed differently. For example, some units may be active in growth markets and others in stagnating or declining markets. In some fields, competition is stiff, and in others not so much.

Choosing the reference figure for calculating the value of the individual business unit

Next we must determine which factor best depicts the value of the business unit – this becomes the reference figure. Reference figures can be sales, earnings, EBIT, EBITDA or cash flow. After that, we determine the value of the reference figure for the business unit in question and this value is weighted using a multiple. This multiple is often derived by comparing the business unit with other companies active in the same industry. In this respect, the sum-of-the-parts analysis is also a multiples method. By choosing the appropriate multiple and multiplying it by the reference figure, we arrive at the "value" of the business unit.

The individual values determined in this fashion – or the value contributions of the individual business units – are then added up to arrive at the total enterprise value. The total of these individual values minus net debt results in the enterprise value according to the sum-of-the-parts method.

Intermarket analysis

Intermarket analysis deals with the reciprocal impact of the different market sectors. The four main sectors are bonds, equities, commodities and currencies. The foremost principle of intermarket analysis is that all organized capital markets are interconnected and a change in one area affects all other areas. Research encompasses not only the influencing factors themselves, but also their evolvement and effects in the course of stock market history. This can include, for example, the effects of interest rate developments on the equity markets or that of the US dollar on commodity prices.

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Guide

Relative value analysis

Relative value analysis uses quantitative methods to examine whether a bond exhibits upside potential or downside risk – in relation to both its own history and a group of comparable bonds.

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Technical analysis

Technical analysis (also called chart analysis) seeks to determine when the most favorable time is for purchasing or selling based on price and sales history of the underlying asset. Technical analysis is based solely on price history and, in some cases, trading volume of the underlying asset. Unlike fundamental analysis, it excludes analysis of the company's business data or the economic climate (e.g. macroeconomic indicators). Chart analysis models can make use of certain geometric patterns or purely statistical, quantitative indicators as "direction indicators".

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Behavioral finance

Behavioral finance is a financial approach that combines conventional economic research methods with psychological methods. This discipline was established in the 1980s and differs from the other disciplines and approaches in that it generally is not based on rational or "benefit-maximizing" economic factors. Behavioral finance methods aim to demonstrate how investment decisions are made and which errors investors typically make in the process.

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Appendix

Recommended literature

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