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(Igor Mocevic)

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List of Abbreviations

AG	Corporation (Ger. Aktiengesellschaft)
Am	Amortization
APT	Arbitrage Pricing Model
APV	Adjusted Present Value
CAPEX	Capital Expenditures
CAPM	Capital Asset Pricing Model
CF	Cash Flow
CRP	Country Risk Premium
BN	Billions
D	Debt (Value of Debt)
DCF	Discounted Cash Flow
DDM	Dividend Discount Model
Dep	Depreciation
Div	Dividend
E	Equity (Value of Equity)
EBIT	Earnings Before Interest and Taxes
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EV	Enterprise Value
FCF	Free Cash Flow
FCFF	Free Cash Flow to Firm
FTE	Flow to Equity
GDP	Gross Domestic Product
IR	Investor Relations
MCAP	Market Capitalization
MM	Millions
MRP	Market Risk Premium
MSCI	Morgan Stanley Capital International
MV	Market Value
NPV	Net Present Value
NWC	Noncash Working Capital
PBV	Price-to-Book Value
PS	Price-to-Sales Value

PP&E	Property Plant and Equipment
PV	Present Value
R&D	Research and Development
rA	Cost of Asset
rd	Cost of Debt
rE	Cost of Equity
rf	Cost of Riskless Investment (risk free rate)
ROE	Return on Equity
t	Period
TC	Marginal Corporation Tax Rate
TV	Terminal Value
V	Value
WACC	Weighted Average Cost of Capital
βE	Equity Beta
βL	Levered Beta
βU	Unlevered Beta
WB	Wienerberger AG

1 Introduction

"*The stock market is filled with individuals who know the price of everything, but the value of nothing*." - Phillip Fisher

Mr. Fisher is probably right. Many people don't differentiate these two terms and price tag is somehow equal to the value of the product, service or a company. To value something is not easy since there are many factors which are in reality very subjective and will not be of the same value to everyone. This is also the case when it comes to company valuation, however, disregarding this issue, there are methods using which a true underlying company can be find or estimated when compared to a peer group or the industry.

This thesis will focus on exactly that, to explain the theory behind the most often used and described valuation methods and to apply this theory on a real-life company. Company chosen for the comparison is an Austrian-based brick-and-mortar company Wienerberger AG which is in construction materials industry. Hopefully, this will shed some light on why these theoretical approaches fail or succeed and which are not appropriate to use in practical terms, as well as how and why these drivers are affecting the outcome of the valuation. Some of them are definitely questionable from the business perspective as well.

First chapter will focus on short introduction of the valuation concept as well as the difference between price and value.

Second chapter will describe the company. Wienerberger AG is one of the oldest listed companies in Austria. It is a production company, geographically diversified and covering developed markets of Western Europe and USA as well as developing markets of Southeastern Europe. This makes the company a perfect candidate for applying and testing various valuation methods.

Third chapter will explain in detail two main approaches in valuation today – Discounted Cash Flow and multiples valuation. This chapter will be the main chapter of the thesis and theory will be applied to Wienerberger AG in order to try to find the intrinsic value

(Discounted Cash Flow Method) or relative value (relative valuation) of the company. Both will be compared with current market price to understand if the company is over-valued or undervalues.

Conclusion chapter will end the thesis.

2 Concept of valuation

This chapter will focus on introducing a concept of valuation as well as concepts of value and price. It will give some insights into why a person or company would engage in the exercise of valuing an asset, what are potential obstacles and what are potential myths regarding the expectation of the outcome of this exercise. Furthermore, it will give insights into the difference of value and price and why one is not equal to the other.

2.1 What is a valuation?

Every asset, financial as well as real, has a value.[1]There are different reasons and occasions in which companies or individuals would perform a valuation of any asset. Furthermore, there must be a distinction between valuing company assets for corporate purposes or investment purposes and valuing assets such as artwork or rare and precious metals. This thesis will focus solely on the first part, valuation of companies and their assets.

There are many reasons an individual or a company would perform a valuation. Most relevant ones might be to value a stock in order to assess whether or not it is overvalued or undervalued and therefore if the stock should be purchased or sold. Also, a company might perform a valuation of a potential takeover target in cases of mergers and acquisitions. In these cases where one company is acquiring the other one, both sides with have a different view and approach when valuing the assets for sale.[2] In addition to these most often used cases, different situations might require a valuation. Sometimes, a company might decide to divest some of the assets in order to consolidate and focus only on the core business. In case of initial public offerings (IPO), companies would perform a valuation to decide on issuing a share price. Sometimes, portfolio managers would estimate the value of multiple companies in order to invest in portfolio of securities and hedge the investment.

When it comes to valuing assets, there are assets that are more complex and harder to value and there are assets that are less difficult to value. For example, mature compa-

[1] Damodaran (2002), p.1
[2] Fernández (2007), p.3

nies with long history and in stable industries are easier to value than startups in the business of disrupting these industries. Furthermore, publicly traded companies are easier to value due to availability of information related to them. On the other hand, trying to value a privately-owned company can be tricky since in many cases, they are not obligated to disclose information on a regular basis, such as publicly traded companies.

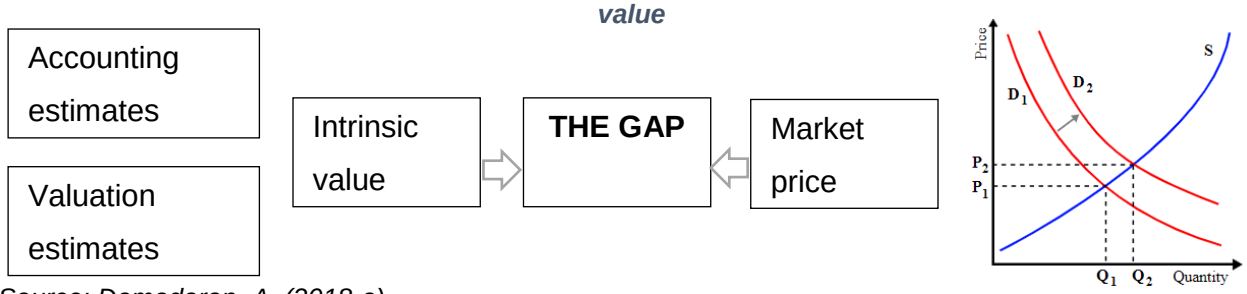
It is also important to note that valuation does not provide an exact measure of value. Even at the end of the most careful and detailed valuation, there will be uncertainty about the final numbers, colored as they are by assumption that we make about the future of the company and the economy. It is unrealistic to expect or demand absolute certainty in valuation, since cash flows and discount rates are estimated.[3] At the end, value should not be confused with price, which is the quantity agreed between the seller and the buyer in the sale of a company.[4]

2.2 Value vs price

It is vital to understand the difference between value and price when it comes to valuing the asset. Damodaran argues that value is coming from fundamentals of the company such as a possibility to generate cash flows while market price is a function of supply and demand. Value can be estimated by using either book value or intrinsic valuation. On the other hand, supply or demand can be driven by fundamental value but can at the same time be driven by the market sentiment or informational asymmetry. Investment decisions are made based on price expectations, and are greatly influenced by an investor's time horizon. In short term time horizons, price reflects opinions of value but as time horizons stretch out, price tends to more realistically represent the competitive nature and value of the firm's earnings and assets.[5] Looking into different types of investment strategies, traders tend to focus on price movements, while investors tend to focus on value, letting the price adjust itself over time.

[3] Damodaran (2002), p.4
[4] Fernández (2007), p.3
[5] Gogerty (2014), p.6

Figure 1: Gap between price and value



Source: Damodaran, A. (2018-a)

3 Applying theory on real life company – story of Wienerberger AG

This chapter will focus on describing main valuation methods and explaining how these can be applied to a real-life company, therefore bridging the academic approach with practical use. These methods will be applied to value Wienerberger AG, an Austrian based production company that is listed on the Vienna stock exchange. Furthermore, basic facts about the company, a short description of the industry, as well as basic financial analysis will be covered. It is important to mention that in real life valuation cases, there are scenarios in which the person who is conducting a valuation has insider information about the company i.e. if the company is divesting some assets and employs an investment bank to do the sales for them, the investment bank will have access to some information not available to the general public. Furthermore, it will incorporate company's explanations on several business drivers such as business cycles, explanation on good or bad years, explanation and guidance on how to approach the business review and how to present the best case to potential investors. In this thesis, only information available to the public and independent investor will be assumed.

3.1 Valuation methods

In general, there are three approaches to valuation. Discounted cash flow method (DCF) focuses on future expected free cash flows available to the company. These

cash flows are then discounted with estimated discount rate. This rate will depend on the method used such as weighted average cost of capital (WACC) or adjusted present value (APV). An expanded explanation of both of these methods will be provided later in the thesis. The second approach is the relative valuation. This method relies on comparing common variables such as earning, book value or sales with other companies that are identified as comparable peers. [6] Multiples analysis can be useful since it doesn't require as many subjective inputs such as growth, or discount rate which can skew the results. Furthermore, trying to understand what is behind the multiples usually forces further and deeper analysis of the company.[7] Third, contingent claim valuation uses option pricing models to measure the value of assets that share option characteristics. These assets can be traded or not, depending on their nature. Some of them can have real assets in their background such as patents or forests in company's possession[8].

3.2 Financial statement analysis

Firms issue financial statements regularly to communicate financial information to investment community.[9] There are four main financial statements commonly used in valuation as well as in financial analysis that help determine financial health of the company. Those are income statement, balance sheet, statement of cash flows and statement of stockholders' equity. These statements are filed usually quarterly and annually in case of publicly traded companies. Generally Accepted Accounting Principles (GAAP) provide a common set of rules and standard format for public companies to use when they prepare their reports.[10] Financial statements remain the primary source of information for most investors and analysts but there are differences in how approach in analysis is giving answers to some main questions about the company.[11] This chapter will not focus on financial statements since they can easily be a topic for themselves,

[6] Damodaran (2002), p.11
[7] Koller, Goedhart, & Wessels (2005), p.371
[8] Damodaran (2002), p.11
[9] Berk & DeMarzo (2007), p.19
[10] Berk & DeMarzo (2007), p.20
[11] Damodaran (2002), p.56

but will rather focus on financial analysis derived from these statements to show health of the company or compare with other companies.

3.2.1 ROE

When it comes to financial performance, return on equity (ROE) is by far the most widely used measure. It is calculated as per formula:[12]

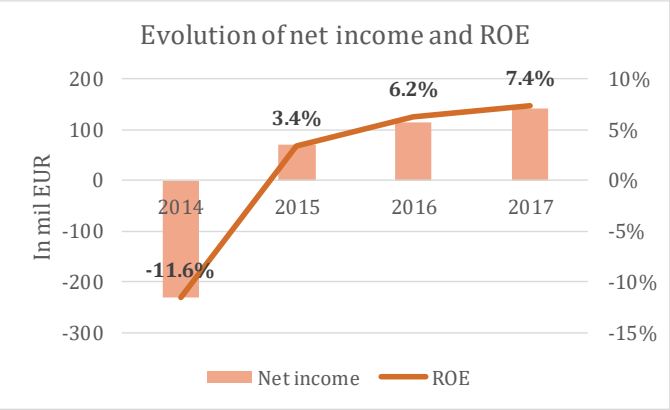
$$ROE = \frac{Net\ income}{Shareholders'\ equity} \quad (1)$$

Return of equity measures the efficiency with which a company employs owners' capital. It is a measure of earnings per dollar of invested equity capital or, equivalently, of the percentage return to owners on their investment.[13] ROE provides a measure of the return that a firm has earned on its past investments. A high ROE may indicate the company is able to find investment opportunities that are very profitable.[14] Although ROE is by far the most widely used measure of financial performance, there are some drawbacks and facts to be considered when using it to compare the performance in the industry or between peers. It is directly driven by management's accounting policy choices. To name a few, it will depend on the method the company decides to use in terms of the speed of depreciation (accelerated vs. straight line) or inventories (first in first out or FIFO vs. weighted average cost of inventory).[15] High ROE is suggesting that the company is able to efficiently employ own capital and generate profit from it, which would most likely increase the stock price.[16]

Applying formula (1) to Wienerberger AG, company financials, we can see the evolution of ROE over the last four years. To better understand the reasons behind the increase, we will breakdown the ROE into components.

[12] Higgins (2012), p.38
[13] Higgins (2012), p.38
[14] Berk & DeMarzo (2007), p.30
[15] Fuhrmann & Asjeet (2016), p.173
[16] Kamar (2017), p. 66-68

Figure 2: Evolution of net income and ROE



Source: Own representation based on annual report 2014-2017

3.2.2 ROE decomposition – DuPont analysis

ROE can be broken down into three measures which give better insights into what management can do to improve ROE. The equation below is showing how ROE is driven by three other very important financial indicators. Developed by scientists at DuPont about a century ago to track that company's performance in its diversified investments, this analysis looks at the profit margin and asset turnover as the building blocks to return on assets.[17] It is actually possible to breakdown this ROE even further than only 3 levers, but since the focus of the thesis lies elsewhere, this will not be covered. The formula for ROE decomposition is:[18]

$$ROE = \frac{Net\ income}{Sales}\ X\ \frac{Sales}{Assets}\ X\ \frac{Assets}{Shareholders'\ equity} \qquad (2)$$

As shown in the formula above, in the first step, ROE consist of three main components[19]:

$$ROE = Profit\ margin\ X\ Asset\ turnover\ X\ Financial\ leverage \qquad (3)$$

All three of these components are giving different views on the company's performance. Furthermore, it gives a better perspective of drivers behind ROE, by identifying and

[17] Mellen & Evans (2018), p.35
[18] Higgins (2012), p.38
[19] Higgins (2012), p.38

quantifying these drivers and can in the end help the management to develop the strategy to improve the returns.[20] It is important to note that ROE makes the connection between company's financial statements and performance. Profit margin summarizes the company's income statement performance by showing profit per dollar of sales. The asset turnover ratio summarizes the company's management of the asset side of its balance sheet by showing the resources required to support sales. Finally financial leverage ratio summarizes management of the liabilities side of the balance sheet by showing the amount of shareholders' equity used to finance assets.[21]

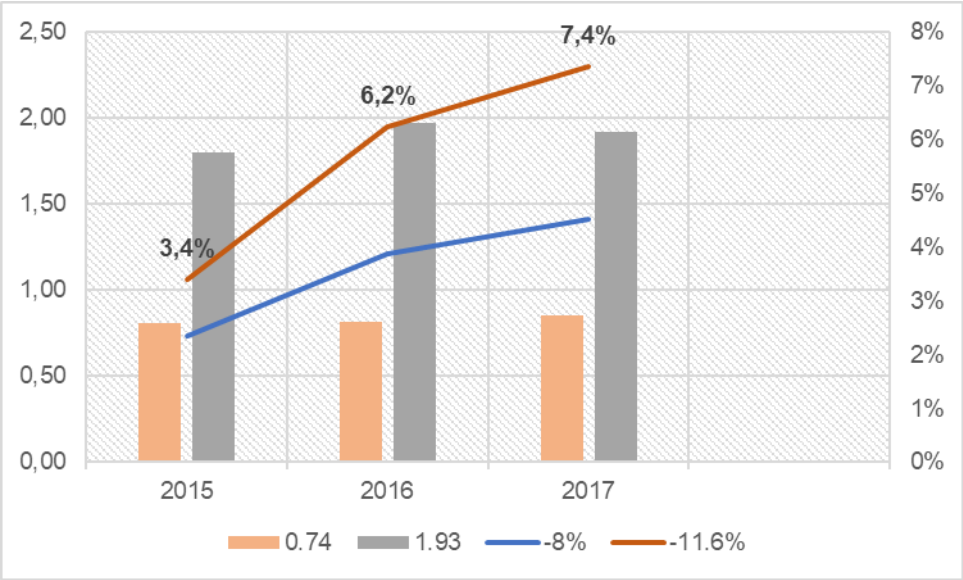
Majority of managers or shareholders easily recognize the importance and the relationship between revenue increase or expense reduction that drive the first block from the formula 3 (profit margin). However, few of them understand and focus on the efficiency of asset utilization from the second block of the formula (asset runover) when it comes to ROE.[22]

It is important to notice that different industries or even different companies in the same industries sometimes have similar ROE but different drivers behind. We can see that technology companies have higher profit margins since they can charge higher prices for their products but at the same time they have lower asset turnover since they are not asset-heavy such as for example brick-and-mortar production companies

Applying this to the company financials, we can get a better picture of what drove ROE increase over last two years which we identified from the figure 2 below:

[20] Mellen & Evans (2018), p.35
[21] Higgins (2012), p.39
[22] Mellen & Evans (2018), p.36

Figure 3: Evolution of a 3-step DuPont analysis



Source: Own representation based on annual report 2014-2017

Profit margin and financial leverage are clear drivers behind the 1-year increase. After that, the company's ROE is clearly driven by margins increase and somewhat by leverage. This is expected in production companies. These companies usually have a lot of assets in their balance sheet and they are capitally intensive, so they require significant CAPEX investments. Only considering these numbers, one can argue that company managed to increase profitability so a deeper look would be needed to understand if this is coming from the price increase, lower COGS due to more efficient production or cheaper raw material sourcing, savings in SG&A etc. Other financial ratios can be calculated from company's financial statements.

3.3 Wienerberger AG

3.3.1 About the company

Wienerberger AG is a multinational company with headquarters in Vienna, Austria. The company was founded in 1819 in Lower Austria and the focus from the beginnings was on innovation in the field of efficiency by, in one way or the other, reducing costs (either by less energy needed or less material etc.). In 1869, the company went through IPO and since then it is listed on the Vienna Stock Exchange. It was a market leader in Austria for a long period of time. Period between First and Second World War they intro-

duced mechanical presses, which meant perforated bricks could be produced. In the end of 1980s, the company started following a strategy of internationalization. After acquiring Oltmanns Group, they expanded into Eastern Europe, UK, France, Belgium, Luxembourg and the Netherlands. During this time, Wienerberger started a joint venture (JV) called Pipelife to enter plastic pipe business area. Acquisition of General Shale in USA, set the step towards being global player.[23]

During the Crisis of 2009, the company went through a restructuring process.

With the takeover of Pipelife in 2012, one of the leading plastic pipe producers in Europe, Wienerberger AG developed a second major business and completed the transformation from a brick producer to an international supplier of application-oriented building material and infrastructure solutions.[24] The management board consists of two people (CEO and CFO) and the supervisory board consists of 11 members.[25]

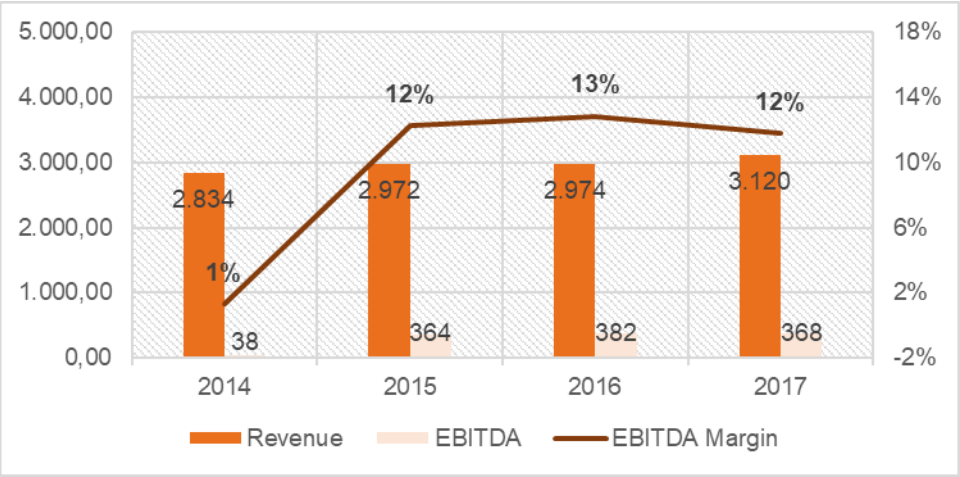
3.3.2 Basic financials

Wienerberger AG has 117,526,764 outstanding shares and it is included in Austria Stock Exchange Index (ATX) with 4.3% of the weight at the end of 2017. The current market capitalization is BN 2.39 EUR based on today's trading price of 20.30 EUR 100% of shares are in free float and publicly traded. The majority of shares are owned by the investors from USA and UK with 54%. Notable shareholders are FMR LLC (Fidelity) from USA with more than 5% and BlackRock, Inc. also from USA with more than 4%.[26]

Looking into historical revenue, Wienerberger AG is showing an increase in performance every year:[27]

[23] Wienerberger AG (2018-a)
[24] Wiener Borse
[25] Wienerberger AG (2018-b)
[26] Wienerberger (2018-c)
[27] Wienerberger (2015), Wienerberger (2016), Wienerberger (2017), Wienerberger (2018-a)

Figure 4: Revenue and EBITDA historical evolution



Source: Own representation based on annual reports 2014-2017

Although there is an obvious growth in revenue YoY in 2015 and 2017 (5%), there is a marginal growth in 2016.

EBITDA is also increasing from 2014 to 2016 and there was a 4% decrease in 2017. Interestingly enough, revenue increased 5% in the same year, so to understand the reasons for this, a deeper income statement analysis is necessary. However it will not be covered, since this is not the main purpose of this thesis. Nevertheless, it is important to note that these trends are very important for future projections of financial statements, which will be covered in later chapters.

ROE calculation is covered in chapter 3.3 and is showing steady increase in the last four years. Judging by these basic financials, Wienerberger AG is a healthy company with steady growth in main performance indicators.

3.3.3 Portfolio

In the portfolio, the company has 5 major product groups:[28]

Wall – these are clay blocks that are used as a standard in building today. They can be used for load-bearing walls or cavity walls of single-family homes or multi-story buildings.

Facade - Facing bricks are used, above all, in visible brick architecture as the most striking aesthetic exterior feature of a building. Walls built with fac-

[28] Wienerberger (2018-a), p.11

ing bricks provides perfect cover against weather conditions and variety of colors and formats are making it ideal for cost-effective urban architecture.

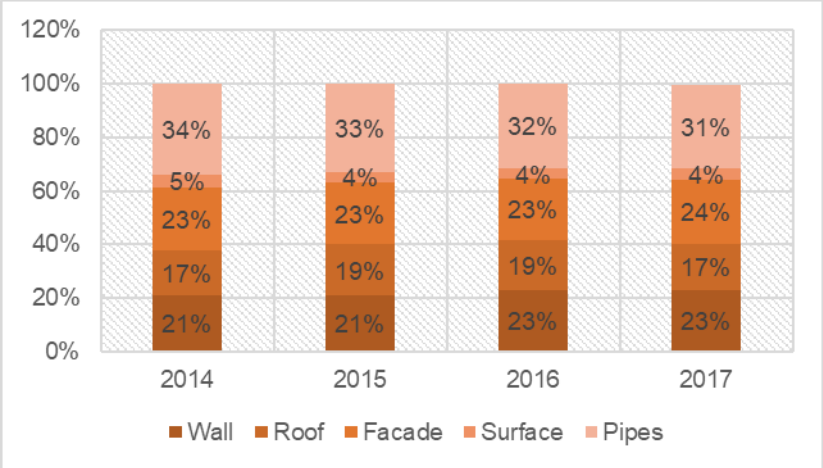
Roof – Roof tiles are used in different kinds of roofs in today's building industry. Broad range of clay tiles is available for modern or traditional solutions.

Pipes - Ceramic pipes (incl. fittings, shafts and accessories) are used in open-trench and trenchless construction, providing sustainable solutions for municipal waste-water disposal accessories) are suitable for a wide variety of applications for private and industrial use.

Surface – Concrete and clay pavers have different applications from public spaces and roads to private gardens.

According to the company's annual report, the percentage of revenue of these products inside of the total sales is very stable year-on-year (YoY). It seems that pipes are somewhat decreasing as a percentage in terms of total revenues while wall blocks are increasing YoY in the horizon of last for years. More details can be seen on the chart below:[29]

Figure 5: Main products breakdown in revenue



Source: Own representation based on annual reports 2014-2017

[29] Wienerberger (2015), p.3, Wienerberger (2016), p.3, Wienerberger (2017), p.3, Wienerberger (2018-a), p.3

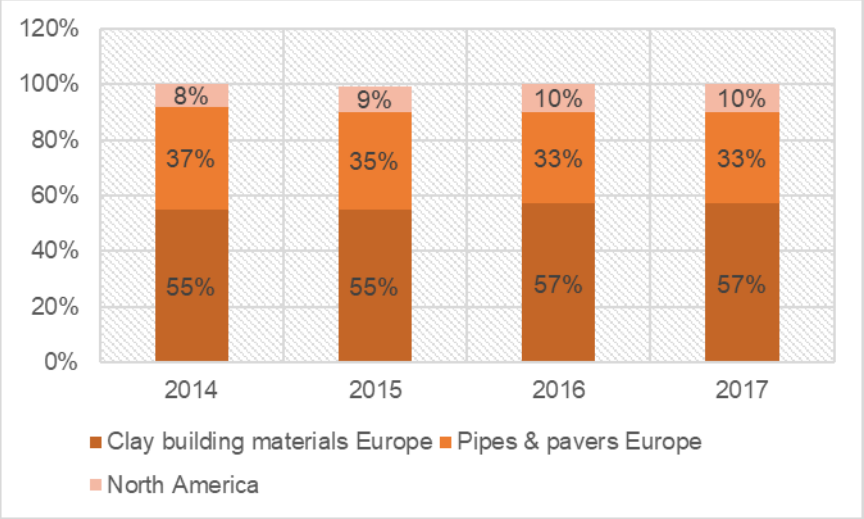
3.3.4 Divisions

There are 3 main divisions and each of them is selling different mix of products from the portfolio mentioned in 3.4.3.:

- Clay building materials Europe
- Pipes & Pavers Europe
- North America

Below is the development of the main division over the years. It seems that clay building materials Europe and North America division are increasing the share of company's business on the account of pipes & pavers. It would be interesting to examine the effects of Pipelife takeover (2012) on revenue structure.

Figure 6: Development of main divisions



Source: Own representation based on annual reports 2014-2017

3.3.5 Industry

Wienerberger AG is a company in the industry of building materials. Since the industry encompasses a huge number of materials, Wienerberger AG is not on the top 10 list of the industry. However, in segments in which they are operating, they are market leaders. Main markets are Europe and North America. When it comes to clay building materials, they are market leader in Europe and one of the main players in North America. In

pipes, they are either market leader or top player in Europe and when it comes to pavers, they are market leader in Central Eastern Europe. [30]

The Industry has several defining characteristics.

First of all, it is a very seasonal industry. There is an increase sales activity during main construction months between May and October. Furthermore, it is very dependent on the weather. Unfavorable weather conditions can reduce the season or disrupt transportation of building activity.

The second characteristic is that is highly dependent on macroeconomic drivers such as Gross Domestic Product (GDP) growth rate, consumer spending or interest rates. There are several approaches to measuring GDP, but if we examine the expenditure approach to measure GDP, this approach takes into consideration consumption, investment, government purchases of goods and services and net exports of goods and services.[31] Although a lot of industries are driven by these factors, it is clear that for the building industry, this is a major driver. This means the industry is very cyclical. The industry can be split into three main parts: Private housing, infrastructure and commercial and institutional buildings. Private housing as well as commercial building is dependent on economic upturn or downturn. Infrastructure and institutional buildings are, on the other hand, reliant on government spending.

The third major characteristic is that the industry is experiencing complex legal framework. There is a large number of legal, health and tax regulations in Europe and in North America. New trends are going towards energy efficient housing or automation in the form of “smart houses or commercial buildings”.

At the end, there is a large number of substitutes in the market. The products are not so dependent on brand and research and development (R&D).

3.3.5.1 Porter industry analysis

Michael Porter defined five forces that determine an attractiveness of the industry:[32]

[30] Wienerberger (2018-a)
[31] Abel, Bernake & Croushore (2014), p.56
[32] Porter (1998), p.4

- The entry of new competitors – such as economies of scale, brand identity or capital requirements
- The threat of substitutes – such as switching cost
- The bargaining power of buyers – such as price sensitivity, buyer volume, product differences etc.
- The barganing power of suppliers – such as supplier concentration, switching costs of supplier
- The rivalry among existing competition – such as industry growth, exit barriers etc

It is always hard to perform an industry analysis with the information available to the public, since available free reports are always lagging 2-3 years so, here is summarized industry analysis: The building materials industry has a moderate competitiveness level. There are substantial entry barriers since it is a capitally intense industry. Vertically integrated players have low impact from suppliers' bargaining power but the buyers' power is strong, since there are no branding and no switching costs. Furthermore, there are plenty of substitutes, and rivalry among existing players is very high due to a lack of diversification.

3.4 DCF valuation – facts and methods

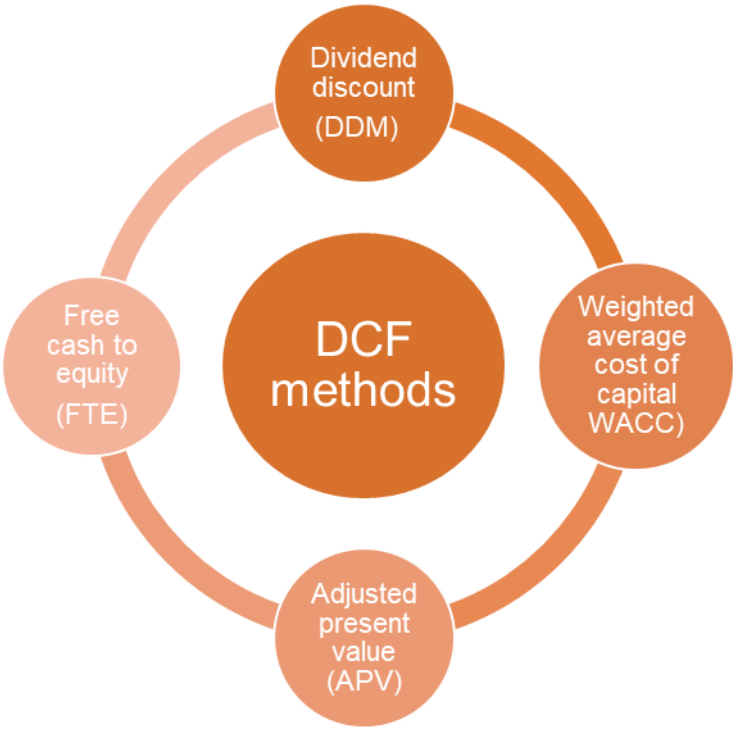
As mentioned in the introduction about the valuation methods in chapter 3.1. discounted cash flow or DCF valuation is one of the three methods used to value an asset. This chapter will focus on explaining DCF valuations methods and it will show the practical side of using them on real life company to determine the value. Furthermore, it will show why all of them are not a good choice when it comes to valuing all types of companies. Some of them are good for start-ups, some are better for mature companies in later stage of the cycle. Some methods rely on dividend payments.

Once shown which method is best applicable to the company such as Wienerberger AG, a deeper explanation of these methods will be presented together with the clarification of main parts needed for such valuation. At the end, all these will be applied to

Wienerberger AG to practically show the bridge between concepts and a real-life company.

There are several methods that are discounting available cash flows to value the company. Those cash flows can come in the form of a payout through dividends or in the form of future cash through potential selling of the common stock owned. There are four main DCF methods:

Figure 7: Main DCF valuation methods



Source: Own representation based on: Damodaran (2001), p.12-13

All models should yield same results if applied correctly[33]. However, these models depend on certain assumptions about the future performance that might influence the valuation.

Although more complex than relative valuation models, DCF models are a basis for any valuation because they encompass the fundamentals of the company and its performance through the analysis and assumptions needed to build the model.

[33] Koller, Goedhart, & Wessels (2005), p.103

DCF valuation is based on the concept of a present value (PV).[34] The process of moving a value or cash flow backward in time – finding the equivalent value today of a future cash flow – is known as discounting. [35] The concept of discounting is based on the premise that the value of a company can be determined by forecasting the future financial performance of the business and identifying the surplus cash flow or earnings that the business generates.[36]

Basic formula to calculate the present value of a cash flow is:

$$Value = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t} \qquad (4)$$

Where n = Life of the asset

CF_t = Cash flow in the period t

r = Discount rate reflecting the riskiness of the estimated cash flows

Cash flow measure will depend on the asset being valued. It can be a dividend payout, free cash flow to the company, equity, EBIT and so on. The time period will also vary based on the asset. Discount rate will be a function of the riskiness of the estimated cash flows, with higher rate for riskier assets and lower rates for safer projects. [37]

In the next part of the thesis DDM and WACC will be explained in more details.

3.4.1 Dividend discount method

In the strictest sense, the only cashflow you receive from a firm when you buy publicly traded stock in it, is a dividend.[38] Dividend discount model (DDM) is using future dividends to measure current value of the company. The model is using the approach of preset value where current stock value is the sum of future dividends, discounted at a certain discount rate.

The general formula for calculating current value of future dividends is:

[34] Damodaran (2002), p.11
[35] Berk, DeMarzo (2007), p.87
[36] Mellen & Evans(2018),p.124
[37] Damodaran (2002), p.12
[38] Damodaran (2002), p.322

$$Value\ per\ share\ of\ stock = \sum_{t=1}^{t=\infty} \frac{E(DPS)t}{(1+k_e)^t} \quad (5)$$

Where DPS_t = Expected dividends per share

k_e = Cost of equity

However, estimating these dividends for the future is not easy, especially if we are talking about distant future. Therefore, it is assumed that the dividends will grow at the constant rate in the long run.[39]

If long term and constant growth rate is assumed, constant dividend growth model or Gordon Growth model can be applied. It is named after the professor Myron J. Gordon, who was arguing that the value of the stock is a function of the growth of the dividend. The growth is constant and the investor is buying the stock with dividend expectation.[40]

There are few assumptions needed in order for this model to be viable. One of them is that all cash flows must be either redistributed to owners or reinvested in the enterprise at the certain discount rate [41] since companies always have 3 choices: reinvest all cash flows, distribute all cash flows or distribute a portion and reinvest a portion.

Basic Gordon Growth model can be written as follows:

$$Value\ per\ share\ of\ stock = \frac{DPS_1}{(k_e - g)} \quad (6)$$

Where DPS_t = Expected dividends per share next year

k_e = Cost of equity

g = Dividend growth rate

It is obvious from the formula above that 3 main inputs need to be calculated before an estimate for company's share price can be found.

[39] Berk & DeMarzo (2007), p.249
[40] Gordon (1962), p.48
[41] Mercer & Harms (2008), p. 4

3.4.1.1 Asset-pricing models

Cost of equity estimation would require estimation of expected rate of return of the company stock. Since this is unobservable, asset-pricing model must be used that translates risk into expected return.[42]

There are many models which are translating risk into expected return but this thesis will focus on two mains and widely used ones and eventually use one of them in further calculations.

Most common asset-pricing models widely used are Capital Asset Pricing Model (CAPM), model and Arbitrage Pricing Theory (APT). Next part of the thesis will revise them and one will be used to find cost of equity for Wienerberger AG, even though both have their advantages and disadvantages. These two models differ mostly by how they define non-diversifiable or market risk.[43]

I. Capital Asset Pricing Model (CAPM)

This is by far the mostly used asset-pricing model in the corporate world to determine cost of equity. The model was proposed by as a model of risk by Sharp in his paper in 1964 as well as in by Treynor (1962) and Lintner (1965).[44] Since the model builds on Markowitz portfolio model, it requires the same assumptions:[45]

a) Investors can borrow or lend any amount of money at a risk free rate
b) All investors have homogeneous expectations
c) All investments are infinitely divisible, which means that it is possible to buy and sell fractional shares of any asset or portfolio
d) There are no taxes or transaction costs involved in buying and selling assets.

In this model, investors are diversified and therefore, only market risk is rewarded. An important addition to this model was the introduction of the risk-free asset and applying homogenous expectation assumption. It means that the only difference in investor's

[42] Koller, Goedhart, & Wessels (2005), p.300
[43] Own representation based on: Koller, Goedhart, & Wessels (2005), p.300; Damodaran (2002), p.69
[44] Berk & DeMarzo (2007), p.363
[45] Reilly & Brown (2006), p.231

portfolio will be the weight in risk-free securities in relation to the total portfolio to adjust for their risk aversion or risk seeking satisfying their risk profile. [46] Sharpe proved in his paper from 1964 that in assessing the risk, only the responsiveness of an asset's rate of return to the level of economic activity is relevant.[47] Assets that move with the economy will yield higher returns to incorporate the risk and assets that do not, will return only the interest. In this case, those are risk-free assets.

Expected return of the asset can be written as the risk-free rate and the beta of that asset:[48]

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f] \quad (7)$$

Where $E(R_f)$ = Expected return on asset i

R_f = Risk-free rate

$E(R_f)$ = Expected return on market portfolio

β_i = Beta of asset i

In the CAPM, risk-free rate and market premium (the difference between return of the market and risk-free rate) are common to all companies. The only factor that varies across companies is beta and this is stock's incremental risk for the investor. [49]

II. Arbitrage Pricing Model (APM)

Th arbitrage pricing model is nothing more than a multi-factor CAPM. Ross in his paper from 1976 was arguing that CAPM is too restrictive with the assumptions and that market portfolio cannot capture the total systematic risk. Therefore, risk premium of any marketable security can be written as the sum of the risk premium of each factor that is determining the risk, multiplied by the beta of that factor. No single portfolio is efficient but by combining multiple portfolios, we can construct efficient portfolio.[50] One of the

[46] Berk & DeMarzo (2007), p.365
[47] Sharpe (1964), p.441-442
[48] Damodaran (2002), p.71
[49] Koller, Goedhart, & Wessels (2005), p.301
[50] Berk & DeMarzo (2007), p.410

useful assumptions is that efficient portfolio can be built from several portfolios. APM has 3 major assumptions:[51]

a) Capital markets are perfectly competitive
b) Investors always prefer more wealth with certainty
c) Asset returns can be expressed as a linear function of a set of K risk factors

As mentioned, the main difference is that there is no assumption of a market portfolio which encompasses all risky assets. These factors are up to interpretation of every investor. It can be GDP or interest rates. General formula of the model is:[52]

$$E(R) = R_f + \beta_1[E(R_1) - R_f] + \beta_2[E(R_2) - R_f] + \cdots + \beta_k[E(R_k) - R_f] \quad (8)$$

Where R_f = Expected return on a zero-beta portfolio

$E(R_j)$ = Expected return on a portfolio with factor beta of 1 for factor j, and zero for all other factors (where j = 1, 2,…,K factors)

Terms in brackets can be seen as risk premiums of these factors in the model. It is easy to see that CAPM can be interpreted a simplistic interpretation of APM with only one factor that would explain returns.

III. CAPM vs. APM

Both models obviously have advantages and disadvantages. As we have seen, CAPM is just a simplified APM model where only one factor is used to capture the systemic risk. This gives it simplicity needed to be used in practice. On the other hand, APM can in some cases fit better since it is using multiple factors to explain risk. Weston found in one study that specific industries will yield different observations when CAPM or APM is used. This is intuitive and it stands to reason even without empirical proof that the more factors are added, the better is the risk captured. However, it seems that APM does a better job in explaining historical returns, while it lacks the power when it comes to projecting the expected returns in the future.[53] This also makes sense since first, the fac-

[51] Reilly & Brown (2006), p.271
[52] Damodaran (2002), p.73
[53] Damodaran (2002), p.78

tors should again be found that would potentially capture the risk, and second, these betas should be projected. These points are valid enough, together with the simplicity of the model to argue for the use of CAPM and therefore, CAPM will be used in the thesis to find cost of equity.

3.4.1.2 Cost of equity

The cost of equity is one of the main components used for any DCF valuation method. In the previous chapter it was stated that CAPM will be used to estimate cost of equity. This chapter will explain main ways of calculating cost of equity and later on, apply these in showing what would be implied cost of equity for Wienerberger AG. Together with other main factors of the formula, it will be used to calculate the stock price using DDM method.

It is crucial to apply appropriate discount rates that would reflect the risk of the underlying asset or in this case, its cash flows. Therefore, cost of equity need to reflect the equity risk premium.

It would also be useful to define the risk. In finance, risk refers to the difference between expected return an investor is expecting to receive on an asset, and the actual return received over the period of holding the asset.[54]

From CAPM equation (7) it is clear that main factors to calculate cost of equity are risk-free rate, beta and market risk premium.

3.4.1.2.1 Risk-free rate

In the previous chapter, risk is defined as a difference between expected return an investor is expecting to receive on an asset and the actual return received over the period of holding the asset. So, following this simplified defining, what assets are risk free? What assets tend to have expected returns same as real returns?

Academia and practitioners agree that government long term bonds have the characteristics of a risk-free asset. Although government bonds are not entirely risk-free (risk-free assets should have beta of 0 and therefore, using CAPM equation, return of the asset

[54] Damodaran (2002), p.61

would be equal to risk-free rate and we don't with certainty its returns), United States and Western Europe long term government bonds have extremely low betas.[55] Furthermore, risk-free assets should have no default risk. This rules out corporations since even the biggest ones carry some default risk. That leaves government bonds, not because they are better managed than corporation, but because government oversees printing money.[56] Additionally, the duration of the government bond should be matched with the invest horizon. To value short-term, risk-free should be a short-term government bond. To value long-term investment, risk-free should be a long-term government bond. There is a possibility to use multiple risk-free rates for every period of the project but in practice, simpler approach of using one is used.

So, what is the risk-free rate appropriate for Wienerberger AG?

Koller, Goedhart and Wessels agree that German 10-year bond should be used when valuing European companies. One important concept to add is that risk-free asset should match the currency of the company to avoid inflation influences. [57]

Figure 8: German bond yields

NAME	COUPON	PRICE	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
GTDEM2Y:GOV **Germany Bund 2 Year Yield**	0.00	101.20	-0.64%	-2	-11	+14	10/26/2018
GTDEM5Y:GOV **Germany Bund 5 Year Yield**	0.00	101.09	-0.22%	-3	-13	+14	10/26/2018
GTDEM10Y:GOV **Germany Bund 10 Year Yield**	0.25	99.03	0.35%	-5	-12	-3	10/26/2018
GTDEM30Y:GOV **Germany Bund 30 Year Yield**	1.25	106.66	0.99%	-4	-8	-29	10/26/2018

Source: Bloomberg (2018-a)

It is easy to see in figure 8 that the yield on German 10-year bond is 0.35%. Now, it is possible to use this as a risk-free rate without any further thinking or analysis, but it is quite obvious that this yield is historically low. There are numerous macro-economic factors for this. One of the main reason is that in turbulent macroeconomic circumstances in Europe in last couple of years, the German bond is perceived as extremely safe.

[55] Koller, Goedhart, & Wessels (2005), p.302
[56] Damodaran (2002), p.154
[57] Koller, Goedhart, & Wessels (2005), p.303

Recently, Germany for the first time issued a bond with negative interest rate.[58] This effectively means that the investors are accepting to pay an interest to state of Germany for owning a German bond and therefore avoiding risk.

This low-yields environment is temporary and will not hold. The figure below shows historical evolution of German 10-year bonds:

Figure 9: Historical evolution of German 10-year bond

Source: Financial Times (2016)

For comparison, US 10-year bond has significantly higher yields.

Figure 10: 10-year US government bonds

NAME	COUPON	PRICE	YIELD	1 MONTH	1 YEAR	TIME (EDT)
GB3:GOV **3 Month**	0.00	2.28	2.32%	+12	+122	10/26/2018
GB6:GOV **6 Month**	0.00	2.40	2.46%	+10	+119	10/26/2018
GB12:GOV **12 Month**	0.00	2.53	2.61%	+5	+120	10/26/2018
GT2:GOV **2 Year**	2.88	100.13	2.81%	-1	+122	10/26/2018
GT5:GOV **5 Year**	2.88	99.85	2.91%	-5	+88	10/26/2018
GT10:GOV **10 Year**	2.88	98.31	3.08%	+1	+67	10/26/2018
GT30:GOV **30 Year**	3.00	94.16	3.31%	+10	+39	10/26/2018

Source: Bloomberg (2018-b)

[58] Financial Times (2016)

The conclusion is that this low-yield environment will not hold forever or for a long period of time and since we are valuing the company and assuming long-term (companies are assumed to have infinite lives), some correction on risk-free rate is needed. Since pre-crisis German 10-year yield was around 4% and today, it is close to 0% and American 10 year bond is 3.08%, for this valuation risk-free rate assumed will be 3%.

3.4.1.2.2 Market risk premium

Extrapolating from the chapter about asset-pricing models, market risk premium (MRP) is the difference between market expected return and risk-free rate. This is one of the most researched topics in finance, where one part of this debate is already covered in aforementioned chapter. Unfortunately, this measure is not absolute, which means proxy has to be used. A common thing for all methods is that they measure risk from a perspective of the marginal investor in an asset, and that this investor is well diversified.[59] There are several methods to estimate market risk:[60]

a) Estimating future risk premiums over historical returns
b) Using regression analysis on ratios such as dividend-to-price ratio
c) Using DCF valuation, along with estimates of return on investment and growth, to reverse engineer the market's cost of capital.

The first method of measuring historical return would require a comparison of a diversified portfolio with risk-free rate over historical period of time. This can be used to value future risk premium. Since diversified portfolio should be used, an index is a good proxy for this type of portfolio. This index is then compared with a default-free government bond.[61] This approach usually yields good results, but there are also drawbacks. First, it is dependent on the time period used, choice of risk-free security and type of average (arithmetic or geometric) used for returns of the portfolio.[62]

Time period argument stands to reason since it is always recommended to use the longest possible horizon. However, by doing this, the assumption is that level of risk

[59] Damodaran (2002), p.158
[60] Koller, Goedhart, & Wessels (2005), p.303
[61] Chisholm (2009), p.178
[62] Damodaran (2002), p.160-161

averseness did not change, which is a dangerous statement. Furthermore, looking into historical risk premiums in US, they might be exaggerated. 20th century was a period of unparalleled growth in US and capital markets did not have interruptions such as financial markets of other markets worldwide. This might suggest that these excessive returns cannot hold the same level in future.[63] Finally, the method of historical returns is even more scrutinized once applied to European markets that is the case of Wienerberger AG. Although the markets of Western Europe are mature, their equity markets are not. They are dominated by a few large companies, many businesses are still private and trading is with much lower volume compared to the US.[64] Therefore, this method cannot be applied in the case of Wienerberger AG.

The second method is a regression analysis on current financial ratios to estimate the expected return of stocks. Several researchers tested this concept. Jonathan Lewellen proved that discount yield can predict stock returns although with bias of a small sample.[65] However, some of the predicted returns were negative and they tend to be lower than historical. Same was argued by Damodaran, who showed this difference by using an implied equity premium where market as a proxy was used.[66]

After consideration to calculate the MRP of Wienerberger AG, modified historical risk premium approach will be used.

The equity risk premium part of the CAPM equation (7) can be rewritten as follows:[67]

$$Equity\ risk\ premium = Base\ premium\ for\ mature\ equity\ market + country\ premium \quad (9)$$

In this case, equity risk premium is equal to market risk premium. Starting from the right part of the equation, there are arguments that country premium should not be a factor. This might hold if it is possible for an investor to diversify this type of country risk. If an investor is globally diversified, there should be no reason to add premium for country risk when investing in assets that are only geographically dispersed. These assumptions do not account for psychological barrier for investor not to expect the premium

[63] Chisholm (2009), p.179
[64] Damodaran (2002), p.163
[65] Lewellen (2004), p. 229
[66] Damodaran (2002), p.175
[67] Damodaran (2002), p.164

when investing in developing country versus the investment in an asset in developed market. The second point is that even if the investor is globally diversified, he or she cannot diversify successfully if there is a correlation across markets. In other words, this risk must be market specific.[68] There are multiple examples in recent history that showed the opposite. Today's markets are intertwined and rarely any risk is country specific. There is an argument for smaller countries but considering the effects of the events such as Russian default in 1998 or Lehman Brothers collapse in 2008, global diversification would not hold sway.

Therefore, the country premium has to be added when calculating equity premium.

One of the ways to measure a country risk is using credit rating agencies. Although these do not measure equity but default risk, they can be used as proxy since they are using many variables relevant for equity risk, such as stability of a currency or political stability.[69] Damodaran is regularly keeping track of these country risks, so his research will be used to calculate the country risk for Wienerberger AG. Considering the company's revenues, it can be observed that they are present in unstable markets, not only in business related terms but also for example due to the political risk. This is the case for Eastern European markets. Having this in mind, using rating agencies as a proxy is ideal since the rating takes political risk into account. In case of Wienerberger AG, or any other multinational corporation, it is impossible to use one country risk figure since they are present in different countries. Therefore, a weighted proxy should be calculated. In case of Wienerberger AG, geographical revenue spit will be used to measure a country risk by multiplying it with Damodaran's country risk premiums. Some of the countries will have 0% country risk premium since their default risk is considered nonexistent.

[68] Damodaran (2002), p.165
[69] Damodaran (2002), p.166

Table 1: Country risk premium estimation for Wienerberger AG:

Geographical revenues 2018	Total	Weight	CRP
Austria	226.73	7%	0.46%
Czech Republic	127.55	4%	0.81%
Poland	205.51	7%	0.98%
Romania	76.31	2%	2.54%
Hungary	92.83	3%	2.54%
Others Eastern Europe	274.46	9%	2.69%
Germany	276.76	9%	0.00%
United Kingdom	320.61	10%	0.57%
Belgium	277.51	9%	0.70%
Netherlands	268.94	9%	0.00%
France	215.35	7%	0.57%
Finland	74.66	2%	0.46%
Sweden	99.40	3%	0.00%
Norway	117.18	4%	0.00%
Others Western Europe	148.36	5%	0.93%
USA	277.34	9%	0.00%
Others North America	31.40	1%	0.00%
		Weighted CRP	0.72%

Source: Own representation based on Damodaran (2018-c)

Going back to the formula (9), base premium for mature equity market needs to be added. Damodaran calculated an implied equity risk premium for S&P 500 over the government bond and found it to be 5.08%.[70] Since US is considered to be a mature equity market, this is a good proxy and it will be used to consider equity risk premium for WB. Going back to the formula, market risk premium will be:

$$5.08\% + 0.72\% = 5.80\% \quad (10)$$

3.4.1.2.3 Measuring Systematic Risk – Beta

As mentioned in previous chapters, only systematic risk of an asset is rewarded by higher returns. Beta measures a movement of stock's returns against a return of a perfectly diversified portfolio. In other words, beta measures the sensitivity of a security to market-wide risk factors. It means it estimates the sensitivity to general economic condi-

[70] Damodaran (2018-b)

tions assumed to be captured in this perfectly diversified portfolio. As already stated earlier, a perfectly diversified portfolio would represent such portfolio for which a risk cannot be further reduced without reducing expected returns and usually indices are used. Beta would then represent a percentage change of the return of a security versus a change in returns of an index. [71] Beta of 2 would represent a change of 2% of returns of an asset while the market would experience 1% change in returns. Consequently, beta of 0.5 would present a change in returns of 0.5% versus the market change of 1%. Beta cannot be observed so it has to be estimated.

There are two main methods of calculating the beta:[72]

a) Regression of stock return against the return of the market, also known as historical market beta
b) Using average industry beta to estimate company beta, also known as bottom-up beta

A widely used method of estimating beta is a regression of returns of the stock against he returns of a market, or index as a proxy for the market:[73]

$$R_{j=} \alpha + \beta R_m + \varepsilon \qquad (11)$$

Where α = Intercept from the regression

β = Slope of the regression

As mentioned, an index is usually used as proxy for the market portfolio. It is important to notice that the choice of an index will heavily impact the outcome. Actually, there are two main factors that need to be decided when using the regression method and those are an index representing market portfolio and the horizon to estimate the beta.

There are several options when it comes to choosing the appropriate index. For US stocks, the most commonly used index is S&P 500. Although it is intuitive to use the index of a country where the company is quoted, this is not a good idea. The reason behind this is that for most countries, the index is heavily weighted in few industries or few companies are contributing to it with a large weight. This would mean that the beta

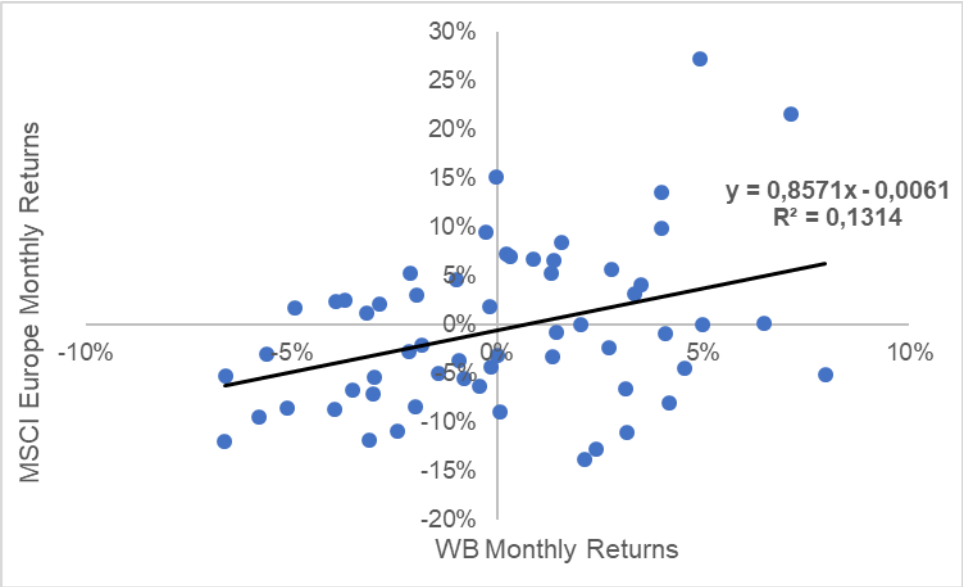
[71] Berk & DeMarzo (2007), pp.308-309
[72] Damodaran (2002), p.182
[73] Koller, Goedhart, & Wessels (2005), p.312

would show company's sensitivity to a particular industry instead of to a wide market systematic risk.[74] Furthermore, this might be a reasonable measure of risk for domestic investor, but not for an international investor who would be better served by an index with wider portfolio that would capture wider risk.[75]

Regarding the horizon to estimate beta, CAPM does not give guidance in how long the horizon should be or which returns should be observed. Stock and index returns are measured daily, weekly, monthly or even yearly. Which measure is better? There are several institutions that are measuring betas and some practitioners are using those in their valuations. Logically, these betas will be different. Reilly and Wright in 1988 proved that the difference between Merrill Lynch data that uses monthly returns and Value Line that uses weekly returns is due to the interval used.[76] Furthermore, using more frequent weekly returns might lead to systematic biases and it is particularly problematic if the stock is not traded daily, since these returns will be zero and that will skew the beta.[77] What about the horizon? Koller, Goedhart & Wessels agree that the regression should have at least 60 observations and monthly returns should be used.[78] This translates into 5-year historic returns. Furthermore, other researchers proved that the 5-year horizon is outperforming other models.[79] Interesting to add is that estimated beta coefficients tend to regress toward one over time which means that less risky and more risky stocks would in long go toward the median. [80] As a conclusion, this thesis will use 5-year monthly European equity index MSCI Europe which stands for Morgan Stanley Capital International and captures companies across 15 developed markets in Europe.[81]

[74] Koller, Goedhart, & Wessels (2005), p.316
[75] Damodaran (2002), p.187
[76] Reilly & Wright (1988), p.68
[77] Koller, Goedhart, & Wessels (2005), p.314-315
[78] Koller, Goedhart, & Wessels (2005), p.314
[79] Groenewold & Fraser (2000), p.979
[80] Blume (1975), p.795
[81] MSCI Europe Index (2018)

Figure 11: WB stock returns vs MSCI Europe returns, 2013-2018



Source: Own interpretation of Yahoo finance (2018) and Investing (2018)

From the regression, solid line represents the best fit between stock returns of the Company and the Index and the slope of this line is the beta. From the equation, beta is 0.8571. This means that for every 1% change in index returns, there will be a 0.86% change in returns of the stock. Furthermore, R squared is 0.1314. This represents the percentage of the risk that come from market sources (13.14%) and the rest (86.86%) comes from firm specific sources. Now, further statistical conclusions can be drawn from the summary of the regression:

Table 2: Summary output of WB regression against MSCI Europe

Regression Statistics	
Multiple R	0.362485809
R Square	0.131395962
Adjusted R Square	0.116157294
Standard Error	0.077788979
Observations	59

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.052176047	0.052176047	8.622536249	0.004781779
Residual	57	0.344914143	0.006051125		
Total	58	0.397090191			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.006063409	0.010128578	-0.598643649	0.551782234	-0.026345536	0.014218718	-0.026345536	0.014218718
X Variable 1	0.857075069	0.291877991	2.936415544	0.004781779	0.272599474	1.441550664	0.272599474	1.441550664

Source: Own representation of Yahoo finance (2018) and Investing (2018)

One further useful information can be taken from the regression – standard error. In this case, standard error is 0.08 and it can be used to show with what confidence level is

this beta estimated. Under normal distribution, by subtracting and adding one standard error, it can be concluded with 67% confidence that the beta is between 0.78 and 0.92 and using two standard errors, it can be concluded with 95% confidence that the beta is between 0.69 and 1.01. This range is in fact not so wide.

Another method to estimate the beta is to calculate it from the group of comparable companies. This approach is called bottom-up beta. This approach starts by identifying a peer-group of companies.

Picking the companies for this group is not a precise endeavor and it is highly subjective but in general, these companies should be comparable in size, industry, type of products, business model etc. This method is making few important assumptions. First one is the notion that beta of two assets put together is the weighted average of the individual betas, where the weight is based on market value.[82] Second one is that the companies in same industry or similar companies (depending on the criteria for peer group), should have similar operating risks so they should have similar operating betas.[83] One important difference must be observed and that is a leverage. Companies for peer-group will have different leverage and that is acceptable.

Once a peer-group is identified, median levered beta (levered due to tax shield effect from debt) together with average tax rate and market debt/equity (D/E) should be calculated. These will be used to de-lever and later re-lever Company's beta, therefore arriving to an industry-adjusted beta.

Formula for unlevering beta using industry peers is:[84]

$$Unlevered\ beta_{company} = \frac{Beta_{peers}}{[1+(1-t)x\left(\frac{D}{E}_{peers}\right)]} \qquad (12)$$

Where t = Average group marginal tax rate

D/E= Average leverage of the peer group

$Beta_{peers}$ = Average group beta

[82] Damodaran (2002), p.202
[83] Koller, Goedhart, & Wessels (2005), p.318
[84] Damodaran (2002), p.196

As it can be observed, industry beta can be used to find appropriate company unlevered beta. Unlevered beta from the peer group is then levered with company's optimal capital structure or optimal leverage and marginal tax rate. Unlevered beta is a measure of the market risk without the leverage which is equal to the beta of firm's assets. Unlevered beta measures the risk of firm's business activities without taking into account any additional risk due to leverage. If the firm changes its capital structure without changing the investments, unlevered beta will not change but equity beta will change to adjust for the capital structure change on the risk. [85]

Formula for relevering beta using industry peers is:[86]

$$\beta_L = \beta_U[1 + (1 - t)\left(\frac{D}{E}\right)] \quad (13)$$

Where β_L = Levered beta for equity in the firm

B_U = Unlevered beta of the firm (i.e., the beta of the firm without any debt)

t = Corporate tax rate

D/E = Debt-to-equity ratio (market value)

It is already obvious that it is quite difficult to get access to this information in public. Until recently, professor Damodaran from University of New York was keeping all these records public and available for everyone to download. Recently, due to proprietary information claims, he temporarily removed the raw data on a company level from public so for this thesis, some assumptions must be made. Hopefully he will soon be able to continue with this practice because it is almost impossible and very time consuming to publicly get this info elsewhere.

Furthermore, it is very time consuming to run the regression of every peer from the group against the appropriate index but the hardest part would be to identify market D/E and cash position to adjust the beta (cash has beta of zero).

In the absence of a better publicly available information, Reuters and Yahoo Finance will be used as most reliable and used publicly available sources.

[85] Berk & DeMarzo (2007), pp.443
[86] Damodaran (2002), p.19

Table 3: Peer-group levered beta estimate

Company Name	Industry Group	Country	Broad Group	Beta	Market D/E	Tax rate
Buzzi Unicem SpA	Construction	Italy	Developed Europe	0.95	49.6%	24.00%
Compagnie de Saint-Gobain	Building Materials	France	Developed Europe	1.05	61.1%	33.00%
CRH	Construction	Ireland	Developed Europe	1.12	64.1%	12.50%
HeidelbergCement AG	Construction	Germany	Developed Europe	1.01	78.6%	30.00%
LafargeHolcim	Construction	Switzerland	Developed Europe	1.23	70.7%	18.00%
Imerys SA	Construction	France	Developed Europe	0.89	97.2%	33.00%
Kingspan Group	Building Materials	Ireland	Developed Europe	1.26	55.0%	12.50%
Uponor Oyj	Building Materials	Finland	Developed Europe	1.49	93.5%	20.00%
Titan Cement Company SA	Building Materials	Greece	Developed Europe	0.79	73.9%	29.00%
			Average	***1.09***	***72%***	***23.56%***

Source: Own representation based on Reuters

Using the formula (12) and parameters from the peer group, unlevered beta of the industry is calculated:

$$Unlevered\ beta_{company} = \frac{1.09}{[1 + (1 - 0.2360)x(0.74)]} = 0.696$$

After obtaining the unlevered beta, next step is relevering. As seen from the formula (12), appropriate tax rate should be used and debt-to-equity ratio should be the optimal capital structure.

There are two choices when it comes to tax rate for the valuation – marginal and effective. Effective taxes are easy to calculate from firm's financial statements and they are observable by simply dividing taxes due with taxable income. On the other hand, marginal tax rate is the tax rate firms have to pay on their marginal last dollar of income.[87] There are several arguments as to why marginal rates should be used. Effective tax rate can be extremely low or extremely high due to various conditions such as different depreciation methods, deferred taxes or tax credits. If effective rate is used and the company is at the moment for any reason mentioned is having lower effective tax rate, this will heavily effect the valuation. This is particularly the case in determining terminal value in other DCF methods. Koller, Goedhart and Wessels also agree that the marginal

[87] Damodaran (2002), p.248

tax rate should be used.[88] Since Wieberberger AG is an Austrian company, Austrian marginal tax rate of 25% will be applied.[89]

Regarding the leverage (D/E), next chapters will cover optimal capital structure and cost of debt in depth, once WACC method is introduced. However, for the purpose of only calculating bottom-up beta and comparing with the regression, optimal D/E was found to be 43% based on a minimum WACC. Furthermore, company's average D/E ratio in last 4 years is 44% and the CEO stressed out that the company is careful with financing options whereby they want to focus on growth with keeping financial discipline. Company's D/E last year was 48% and the CEO also pointed out the reduction in debt.[90] It is fair to conclude that the company does not plan to raise debt levels and target ratio of 43% will be used.

Using a target ratio of 43%, relevered beta can be calculated. Using the formula for the levered beta:

$$\beta_L = 0.696[1 + (1 - 0.25) * 0.43] = 0.92 \quad (14)$$

This is not too far from regression beta of 0.86 so for the valuation, an average can be used and therefore, for the purpose of the valuation going forward, beta of 0.9 will be used.

Since now, all factors to calculate cost of equity are estimated, going back to CAPM formula for cost of equity:

$$Cost\ of\ equity = rf + \beta x MRP \quad (15)$$

Which gives a cost of equity for WB of:

$$Cost\ of\ equity_{WB} = 3\% + 0.9 * 5.8\% = 8.22\% \quad (16)$$

3.4.1.3 Terminal growth

In valuation, two types of growth should be differentiated. Value of the company is split into two parts. First one is the value of the first several years in the future (usually 5), and second part is the value of the company as a going concern which is called terminal

[88] Koller, Goedhart, & Wessels (2005), p.328
[89] KPMG (2018)
[90] Wienerberger AG (2018-a)

value (unless there is an assumption of the liquidation of the company after the first part). Therefore, appropriate growth should be assumed when valuing these parts. First part of is sometimes also called explicit forecast period.[91] This thesis will assume the value of the company as a going concern and to find the terminal value, proper growth rate should be estimated. This growth must be stable since it is assumed that the company is growing at this constant rate forever. In general, terminal growth can be estimated as follows:[92]

$$Terminal\ value_t = \frac{Cash\ flow_{t+1}}{(r - Stable\ growth)} \quad (17)$$

Where Cash flow$_{t+1}$ = Cash flow of the first period after the forecasting horizon

r = Discount rate (cost of equity, WACC)

stable growth = Growth at which the company can grow to infinity

Stable growth rate is for the terminal value is so important because it is one of the biggest drivers of the valuation. Reason for this is that even the smallest change can change the terminal value or the share price significantly. The importance of the terminal value depends essentially on two parameters: the entity of the cash flow of the final year of the first stage and the perpetual growth rate of the second stage. If the forecast of the final cash flow is small relative to the capital invested, it is natural that the valuation largely depends on the assumptions the second stage, as it will take many years to the cash flows to repay the capital invested.[93] Some define terminal value as a value in future where the company has stale growth of profits and investments, or if the company is transforming from growth state to the stable state.[94]

Since this is the growth of the company forever, there are some limitations as to how high it can be. First of all, in any case it shouldn't be higher than the growth of the economy.[95] This is the case even for fast growing technology companies. Assumption is that

[91] Koller, Goedhart, & Wessels (2005), p.275
[92] Damodaran (2002), p.305
[93] Cassia, Plati & Vismara (2007), p.102
[94] Buus (2007), p.51
[95] Damodaran (2002), p.305

they will eventually return to normal growth numbers. This is exactly why multi-stage models are developed and as mentioned, first part of the valuation is the forecasting horizon in which high or low growth can be modeled. Furthermore, if the limitation is the growth of the economy, then it stands to reason to use GDP growth rate. However, multinational companies are present in different countries and that is why it is important to estimate the weighted average if measures such as GDP growth are used.

The second important point is the currency. If the currency of the company is experiencing volatile and high inflation, this should be reflected in the growth, making it higher since future earnings will be affected by it. Since Wienerberger AG is reporting the earnings in EUR and this is not a high-inflation currency, inflation will not be an important factor in determining terminal growth.

Terminal value can also be estimated using comparable multiples of the industry or the peer-group identified. Usually earnings such as P/E or book values are used. Assumption is that these multiples reflect economic prospects in forecasting horizon as well the as the prospect beyond in in continuing value period (CV).[96]

So what growth will be assumed for Wienerberger AG? First of all, a two stage dividend discount model will be used. Therefore, two growth rates need to be estimated as already explained in this chapter.

As Wienerberger AG is highly dependent on the economy movements and industry output, growth rate should be linked to growth rates of these respectable measures. Furthermore, since Wienerberger AG is highly geographically diversified, it stands to reason to use weighted average of company's markets to estimate these figures.

For the forecast period, industry output will be used. For the measure of the output, Euroconstruct estimates will be used. Euroconstruct is a European research network that specializes in construct market analysis and forecasting in EU for the last 40 years and it is a leading authority in Europe.[97] From the latest report, actuals for 2017 and forecast for 2018 and 2019 and used to estimate the output change for 2020-2022.

[96] Koller, Goedhart, & Wessels (2005), p.290
[97] Euroconstruct (2017)

Table 4: Weighted average of the industry growth

Year	2016a	2017a	2018e	2019e	2020e	2021e	2022e
Weighted average growth	***0.87%***	***3.67%***	***3.56%***	***2.98%***	***2.68%***	***2.41%***	***2.17%***

Source: Own representation based on Eurocontruct (2017) and company data

Furthermore, it is already established that the perpetual growth cannot be higher than then the economy. As Wienerberger AG is heavily dependent on economy cycles, weighted GDP growth estimate will be used for terminal growth. Based on International Monetary Fund forecast, weighted average growth of Wienerberger AG in 2022 is estimated to be:

Table 5: Weighted average GDP growth

Year	2022e
Weighted average growth	***1.80%***

Source: Own representation based on IMF (2018) and company data

Finally, Damodaran argues that the beta should be adjusted in the terminal growth and cost of equity recalculated. He states that the beta in terminal value is approaching 1 so terminal value cost of equity using beta of 1 and using the equation (17) is 8.8%

3.4.1.4 Output of the dividend discount model

As a conclusion, putting all the estimated factors will show the implied dividend price of the company. For this DDM method, a two stage model will be used as already explained above. First, this is the output of the model:

Table 6: Present value of the company's future dividends

	1	2	3	4	5	5
Year	2018	2019	2020	2021	2022	TV
EPS	1.04	1.20	1.37	1.52	1.69	1.72
DPS	0.35	0.41	0.47	0.61	0.76	0.80
Cost of equity	8.22%	8.22%	8.22%	8.22%	8.22%	8.80%
PVD	0.33	0.35	0.37	0.44	0.51	8.17

Implied share price	**10.17**

Source: Source: Own representation based on company data and thesis estimates

It is clear from the numbers that majority of the value is coming from terminal value. This is one of the main perils of DCF method. Going behind that, this model will heavily depend on the assumptions of the payout ratio of the company. Will the company decide to payout more or less of its cash? If more cash is redistributed, less remains for the investment and furthermore, in case of economy downturn, less remains for possible crisis effects. Damodaran claims that the payout ratio for mature companies such as WB should not be below 40%[98] which is the case in this model and based on company's historic behavior. Growth assumptions are as well major factor. Since WB is trading at €20.3 this would imply that WB is overpriced.

3.4.2 Weighted average cost of capital approach

While the dividend discount method is measuring the value of only equity in the company, different methods of discounting cash flows are measuring the value of the entire company. Weighted average cost of capital or WACC is probably the most spread discounted cash flow method used in practice. So what is the difference? The difference is primarily from cash flows that are linked to debt (interest payments, new debt etc). Since WACC approach is also DCF approach as dividend discount model from chapter 3.4.1. it will also require discounting cash flows but different discount rate will be used. Furthermore, WACC method can also be one or two stage model. If the company is in the stable growth state, company can be valued used the formula:[99]

$$Value\ of\ the\ firm = \frac{FCFF_1}{WACC - g_n} \quad (18)$$

Where $FCFF_1$ = Expected FCFF next year

WACC = Weighted average cost of capital

g_n = Growth rate in the FCFF forever

[98] Damodaran (2002), p.333
[99] Damodaran (2002), p.385

However, the company is rarely in stable growth already. This can be said for utility companies but today, even this industry is not spared of disruption and therefore, not always is this industry in stable growth. Therefore, a two-stage model is needed[100]:

$$\sum_{t=1}^{t=n} \frac{FCFF_t}{(1+WACC_{hg})^t} + \frac{\left[\frac{FCFF_{n+1}}{WACC_{st}-g_n}\right]}{(1+WACC_{hg})^n} \quad (19)$$

Where WACC = Weighted average cost of capital (hg: high growth; st: stable growth)
Since dividends in chapter 3.4.1. are discounted with equity cost, and it is already mentioned here that WACC approach is including debt, cash flow in this method will be discounted with both debt and equity. Therefore the name – weighted average cost of capital or WACC. Formula for calculating this discount rate is:[101]

$$WACC = \frac{E}{E=D} r_e + \frac{D}{E+D} r_d(1 - t_c) \quad (20)$$

Where E = Value of equity r_d = debt cost of capital

D = Value of debt t_c = marginal corporate tax rate

r_e = equity cost of capital

WACC approach is assuming steady debt-to-equity ratio over time. If this ratio will change, it is still possible to estimate the value but it is more difficult to apply the method.[102] In that case, adjusted present value method (APV) would be more appropriate.
In order to properly use WACC, some criteria must be met[103]:

a) It must include the opportunity cost of all sources of capital (debt and equity)
b) Debt-to-equity ratio must me a target one, not the book value one
c) It must calculated after taxes.
d) Currency has to be the same as cash flow currency

[100] Damodaran (2002), p.388
[101] Berk & DeMarzo (2007), p.577
[102] Koller, Goedhart, & Wessels (2005), p.104
[103] Koller, Goedhart, & Wessels (2005), p.297

It is observable from equations that some factors must be estimated before starting with the valuation. In chapters 3.4.1.2. and 3.4.1.3. the cost of equity, risk free rate, beta and terminal growth were discussed and estimated so next chapter will explain cost of debt.

3.4.2.1 Cost of debt

Cost of debt is one of the major factors when trying to apply WACC method of valuation. One of the ways to find the cost of debt is to simply calculate the yield to maturity of the long term corporate bond issued.[104] Two prerequisites are that the bond is long term and widely traded. Although WB has issued bonds, they are not widely traded. Another way to calculate the cost of debt is to use corporate ratings since the assumption is that rating agencies are incorporating several factors to calculate the rating. Cost of debt will be determined by risk free rate (the higher the rate, the higher is cost of debt) and by default risk (spread will increase as companies are riskier).[105] Credit rating can be used to estimate the cost of debt of companies. The issue with this approach is if the company is not graded. However, WB is rated and therefore the approach is valid. The approach over ratings is assuming the spread and risk-free rate added to it to arrive to cost of debt:

Table 7: Credit ratings and implied cost of debt

If the interest coverage is:				
greater than	less then or equal to	Rating	Spread	Implied cost of debt
-100000	0.50	D2/D	18.60%	21.60%
0.5	0.80	C2/C	13.95%	16.95%
0.8	1.25	Ca2/CC	10.63%	13.63%
1.25	1.50	Caa/CCC	8.64%	11.64%
1.5	2.00	B3/B-	4.37%	7.37%
2	2.50	B2/B	3.57%	6.57%
2.5	3.00	B1/B+	2.98%	5.98%
3	3.50	Ba2/BB	2.38%	5.38%
3.5	4.00	Ba1/BB+	1.98%	4.98%
4	4.50	Baa2/BBB	1.27%	4.27%
4.5	6.00	A3/A-	1.13%	4.13%
6	7.50	A2/A	0.99%	3.99%
7.5	9.50	A1/A+	0.90%	3.90%
9.5	12.50	Aa2/AA	0.72%	3.72%
12.5	100000	Aaa/AAA	0.54%	3.54%

Source: Own representation based on Damodaran (2018-d)

[104] Damodaran (2002), p.208
[105] Damodaran (2002), p.208

As seen in the table, spread is assigned to every rating and this is used to estimate the cost of debt of the company. Risk-free rate must be added to a spread to reach implied cost of debt. How are the companies graded? There are three main credit rating agencies: Moody's, S&P and Fitch. Moody's has rated WB with the rating of Ba1.[106]

Implied rating can be estimated over interest coverage.[107] Once interest coverage is calculated, implied rating and implied cost of debt can be found. Interest coverage is calculated:

$$Interest\ coverage = \frac{EBIT}{Interest\ and\ similar\ expenes} \qquad (21)$$

In case of WB, EBIT for 2017 was MM178.7 EUR and interest expenses MM42.1 EUR which implies an interest coverage of 4.24. According to the table 6, this interest coverage is implying a rating of Baa2 and the cost of debt is 4.27%.

Either of these approaches are viable since this small variation will in any case covered under sensitivity analysis (although implied rating is usually used for non-rated companies) so for this thesis cost of debt of 4.98% will be used following Moody's rating.

3.4.2.2 Optimal capital structure

Capital structure is one of the most important inputs in company's valuation. At the same time, it is one of the more researched topics in finance and economics. So, does capital structure have the impact on value of the company? To answer this, the best way to start is with the Modigliani-Miller first proposition, that was named after two Nobel prize winning economists Franco Modigliani and Merton Miller. Their first proposition states that the company's value of any company in the market is independent of its capital structure and furthermore, average cost of capital is independent of its capital structure.[108] Upon first reading, this statement does not make much sense if observed in real-life market. This is true since MM proposition has certain assumptions under perfect capital markets but main ones are:

[106] Moody's (2018)
[107] Damodaran (2002), p.209
[108] Modigliani & Miller (1958), p 268-269

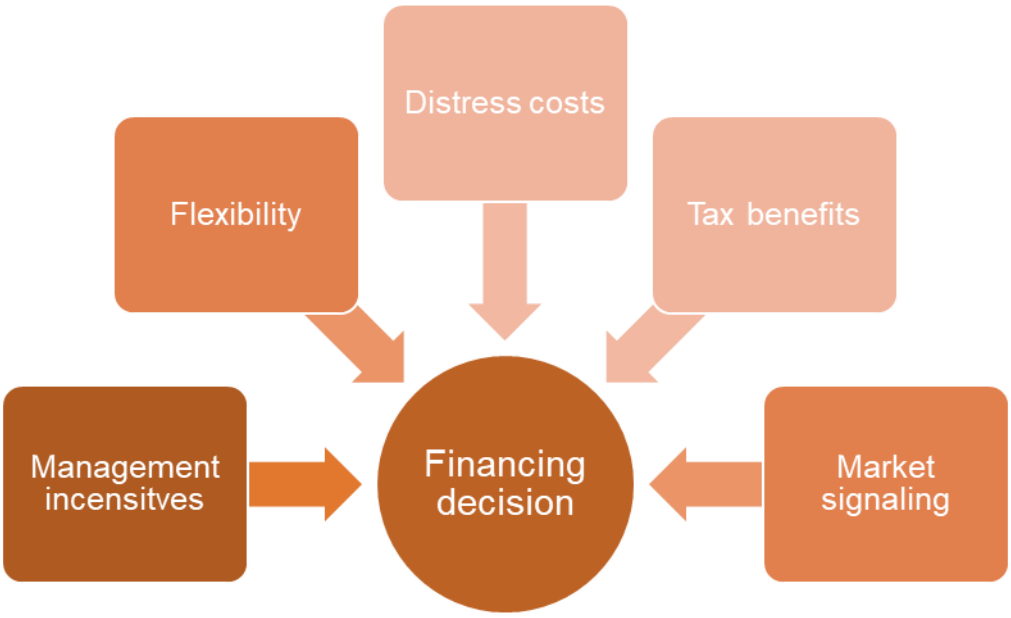
a) No taxes, transaction costs or insurance costs

b) Financing decisions do not affect the generated cash flows and they do not reveal new information

It is easily observable that these assumptions are too far from the reality but the way to look at this hypothesis is that the focus should be on the amount of the cash flows changed by the financing options rather than the and the capital structure should maximize these cash flows. [109]

In reality, there are other factors arising from capital structure decisions and these factors are influencing the value of the firm.

Figure 12: Higgins 5-factor model for financing decisions



Source: Higgins (2018), p.218

As stated above, MM proposition 1 does not take into account taxes. Companies pay corporate income tax which is calculated over the earnings after all the costs, expenses, depreciation, and very important, taxes. This implies that debt financing and interest payments will reduce the tax payments and therefore increase the value of the company.[110] This additional value kept due to less taxes paid is called interest tax shield and total value of the leveraged company is higher than the value of unleveraged company

[109] Higgins (2012), p.218
[110] Berk & DeMarzo (2007), p.460

and the difference is the present value of the tax shield. Some research papers suggest that the value of debt financing from the tax shield is 10% and it can add additional 15% before the benefits of extra debt become downward sloping which suggests that the companies are either extra conservative with debt or the potential distress costs are very high.[111] These benefits are net of personal taxes. MacKie-Mason found out in his paper that the companies with higher marginal tax rates tend to use debt financing while the companies will lower marginal tax rates tend to shy away from the debt.[112]

The next major factor that is affecting the value of the company, is the concept of financial distress and this concept was also disregarded in the MM proposition 1. Without financial distress, companies would simply lever up until the interest payments would equal EBIT and they would therefore maximize the tax shield. However, it is impossible to predict future EBIT with such precision and therefore, it is probable that the interest payment will at one point be higher than EBIT, thereby putting a company in financial distress. The cost of financial distress reduces the value of a levered company and the amount of reduction increases with the probability of a default. This is where it is necessary to introduce the *tradeoff theory* which states that companies should increase the leverage until the value of the company is maximized. After this point, the additional tax benefits are offset by the cost of financial distress.[113] Financial distress costs are basically potential costs if the company defaults on its loans. Since these costs can be substantial and they will reduce the value of the company, financial distress is important factor when capital structure is being decided.

These costs can be split into direct bankruptcy costs after the default or indirect financial distress costs that can occur before or after the bankruptcy.

Direct bankruptcy costs are straightforward and easily calculable. These are the costs related to bankruptcy procedures, costs related to numerous consulting firms such as legal, business, financial or business consultants or costs of creditors related to bank-

[111] Graham (2000), p.1935
[112] MacKie-Mason (1990), p.1489
[113] Berk & DeMarzo (2007), p.402

ruptcy since these proceedings are sometimes taking several years depending on the legal system and the country where the firm is operating. [114]

Indirect financial distress costs can start happening before the actual default. Contrary to the direct ones, they are not directly observable. Some of them are[115]:

Loss of customers – since a company is in financial distress, its future is insecure and customers are afraid they will not receive a service or long-term support. This is particularly visible with technology companies due to expected long-term support and airlines where passengers will not buy tickets in advance

Loss of suppliers – supplier will not deliver goods due to the risk of non-payment unless it is 100% prepayment

Loss of employees – as firms enter financial distress, employees will not see future in the company and will start to look for other prospects

Asset sales – companies in financial distress are forced to sell their assets at discounted price due to cash flow problems

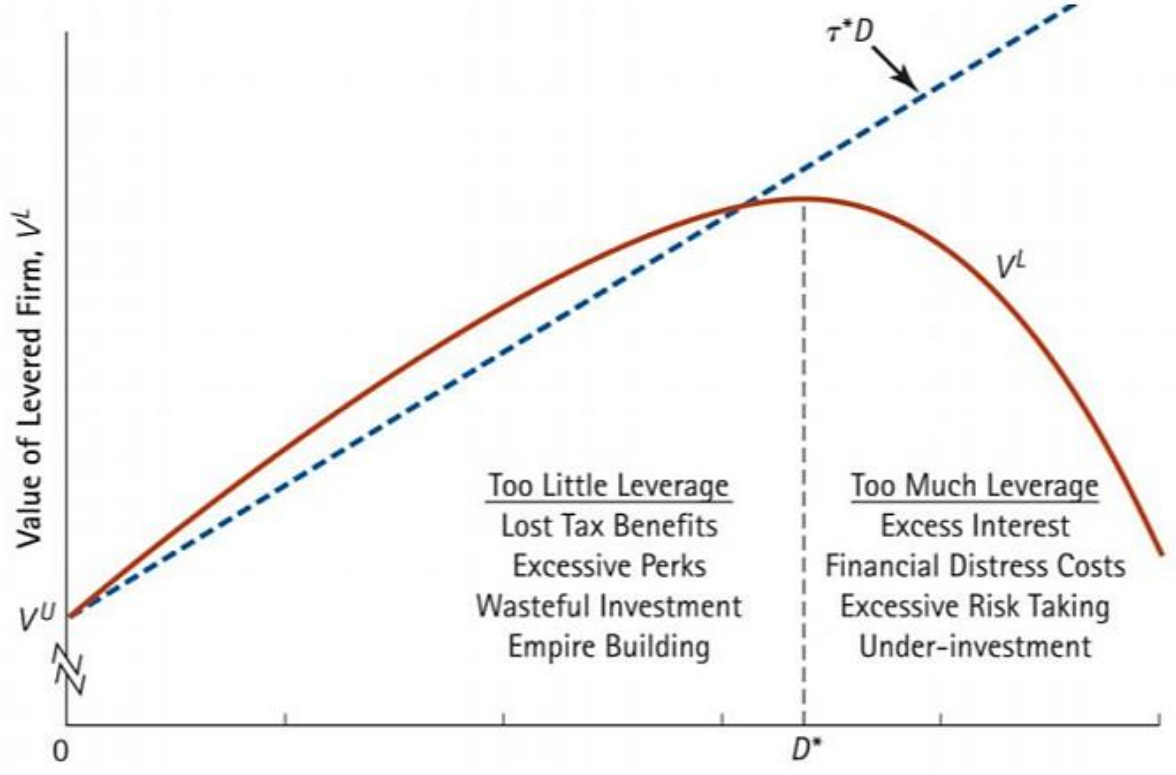
Bankruptcy costs can reach extremely high levels. On average, bankruptcy costs are between 11% and 17% of the company value up to three years before bankruptcy and in some cases over 20% of the company value prior the bankruptcy. Furthermore, present value of many bankrupt firms was found to be higher than the present value of tax shield which is implying they were overleveraged.[116] Furthermore, another study revealed that the average cost of bankruptcy measured as a percentage of pre-bankruptcy assets is between 8-10% (mean) and 2-3% (median).[117] Andrade and Kaplan estimated costs of financial distress to be between 10 and 20% of the firm value.[118] One thing to note is that it is hard to differentiate whether financial distress caused the bad performance or if macroeconomic factors are responsible for the distress in the beginning.

Agency costs and benefits (management incentives) are another factor affecting optimal capital structure. Agency problems in companies can have positive or negative effects.

[114] Berk & DeMarzo (2007), p.495
[115] Berk & DeMarzo (2007), p.496
[116] Altman (1984), p. 1087-1088
[117] Bris, Welch, & Zhu (2004), p. 6
[118] Andrade & Kaplan (1998), p.1489

For example, when a firm faces financial distress, managers can in some cases take projects which are risky and have negative NPV but the costs will be taken by debt holders.[119] This problem is known as the over-investment problem. Furthermore, there can be cases where managers are not investing in positive NPV projects since majority of the benefits will go to debt holders.[120] This problem is known as under-investment problem.

Figure 13: Optimal leverage with taxes, financial distress and agency cost



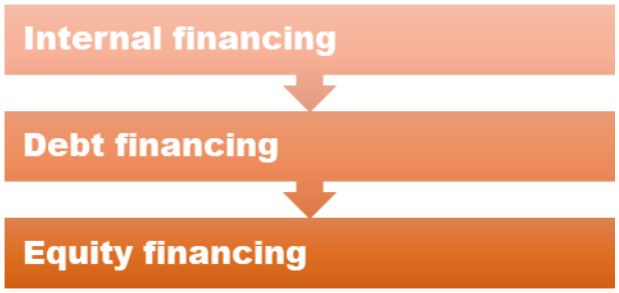
Source: Berk & DeMarzo (2007), p.511

Asymmetric information (market signaling) is referring to the difference of the information available to the managers and the outside investors. Why is this relevant for capital structure? Assuming that the management of the company knows that next few years, the company's earnings will be healthy and growing. If they would finance new projects, it is logical to use debt due to tax shield reasons and since they know the earnings will be health, there is no financial distress. So, if they decide to issue equity, they

[119] Jensen & Meckling (1976), p. 337
[120] Myers (1977), p.171

are signaling the opposite and the investors will assume that the company's management is expecting bad days ahead. This is called adverse selection and it is formalized in a famous paper by George Akerlof.[121] Due to an information asymmetry, buyers will assume that the equity issue is a reflection of company's belief the stock is overpriced and they will buy only at a discount. This was proven in one research paper where it was shown that after the announcement of a new equity issue, returns of the company is falling and the more than 30% of the value of the new equity is lost. Furthermore, companies over performed the market two years prior to the announcement and underperformed one year after.[122] The fact that companies should finance future cash flows in a certain order based on the information they possess is formalized by Myers and it is called pecking order theory:[123]

Figure 14: Pecking order financing



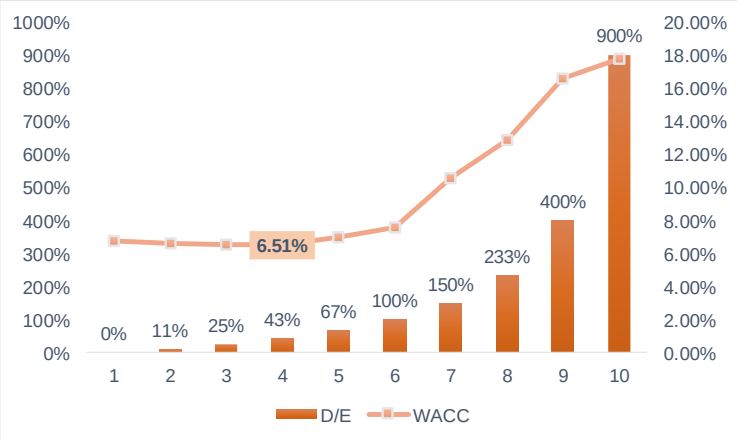
Source: Myers (1984), p.581

So, what is the optimal capital structure of Wienerberger AG to be used in this valuation? One of the ways to find optimal capital structure is to find the cost of capital what is maximizing the value of the company. If we assume that the cash flows to the company are unaffected by the choice of the financing mix, then to maximize the value, minimal cost of capital should be used as optimum.[124]

Applying go-seek method here for multiple options of debt-to-equity ratio using ratings from the table 6, and assuming that the optimal capital structure is the one where WACC is the lowest, optimal leverage for WB is when debt-to-equity ratio is 43%.

[121] Akerlof (1970), p.493
[122] Acquith & Mullins (1985), p.85-86
[123] Myers (1984), p.581
[124] Damodaran (2002), p.404

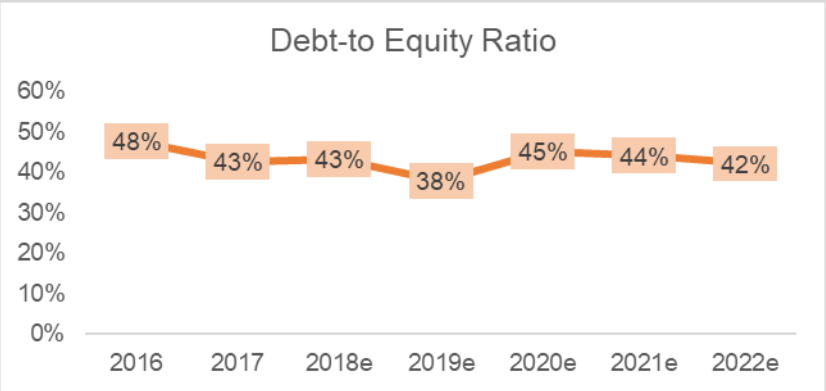
Figure 15: WACC development with change of leverage



Source: Own representation based on Damodaran (2002), company data and thesis estimates

As already mentioned, in WACC method target leverage rather than current leverage should be assumed unless the company is already there, which is precisely the case with WB. Current debt-to-equity ratio is 43% and it is estimated it will on average stay there over the forecasting horizon so 43% will be used as a target ratio for this valuation.

Figure 16: Historical and estimated debt-to-equity ratio



Source: Own representation based on company data and thesis estimates

3.4.2.3 Growth rates

Growth is one of the most important inputs in valuation. Growth of earnings and revenues can be measured or estimated in many ways. It can be estimated looking into historical performance (although, this is not always a good measure for future earnings) or it can be estimated over company's fundamentals from balance sheet and cash flow analysis. Size of the company is also important since it is easier for a small company

with MM50 EUR to achieve 50% growth than for a BN5 EUR.[125] In practice, there is substantial information available about the company when doing the analysis. Many associations and organizations are publishing industry data or company data albeit majority of these reports are for sale. Investment banks work with company's investor relations (IR) to receive additional data. As mentioned at the beginning, this thesis is assuming only publicly available information and therefore, all assumptions are based on that.

When forecasting growth, it is important to know that it is only that, a forecast. A lot of business assumptions are taken such as market size in future, market share of the company, ability to keep customers, ability to control supply chain etc. It is somewhat easier for stable companies but even then, there are innovations that are either not expected or they are but how should they be forecasted in terms of performance if they are not sold yet?[126]

Using fundamentals formula for growth is:[127]

$$Growth = Retention\ ratio\ x\ ROE \quad (22)$$

In this case, this growth rate can be applied to both net income as well as earning per share.

To calculate the growth of WB, two drivers are considered. Since WB is in highly cyclical industry and dependent on the economy, GDP is important driver. On the other hand, as mentioned in 3.4.1.3. Euroconstruct gives very good estimates on industry output per country. Since WB is also present in the US market, US Census Bureau was used to estimate output growth. For years 2020-2022, average YoY change was assumed which is calculated to be -10% so in these years, calculated growth of 2.98% in 2019 is gradually reduced to 2.17% in 2020. For comparison, looking into company's historical performance, average revenue growth in last four years was 3.3% so numbers for future stand to reason.

[125] Damodaran (2002), p.277
[126] Koller, Goedhart, & Wessels (2005), p.240
[127] Damodaran (2002), p.284

As mentioned, yearly growth assumed for forecasting horizon based on weighted average output growth per country of business is:

Table 8: Industry weighted average growth

Year	2016a	2017a	2018e	2019e	2020e	2021e	2022e
Weighted average growth	***0.87%***	***3.67%***	***3.56%***	***2.98%***	***2.68%***	***2.41%***	***2.17%***

Source: Own representation based on Euroconstruct (2017) and company data

Regarding terminal growth, IMF estimates per country are used for 2022 and based on again weighted average of the geographical spread of business, terminal stable growth is estimated:

Table 9: Weighted average GDP growth

Country	Revenues	Weight	2018e	2019e	2020e	2021e	2022e
Austria	226.73	7%	2.8%	2.2%	1.6%	1.5%	1.5%
Czech Republic	127.55	4%	3.1%	3.0%	2.5%	2.5%	2.5%
Poland	205.51	7%	4.4%	3.5%	3.0%	2.8%	2.8%
Romania	76.31	2%	4.0%	3.4%	3.3%	3.2%	3.2%
Hungary	92.83	3%	4.0%	3.3%	2.6%	2.4%	2.2%
Others Eastern Europe	274.46	9%	2.8%	2.5%	2.4%	2.2%	2.1%
Germany	276.76	9%	1.9%	1.9%	1.6%	1.5%	1.3%
United Kingdom	320.61	10%	1.4%	1.5%	1.5%	1.6%	1.6%
Belgium	277.51	9%	1.5%	1.5%	1.5%	1.5%	1.5%
Netherlands	268.94	9%	2.8%	2.6%	2.3%	2.1%	2.0%
France	215.35	7%	1.6%	1.6%	1.6%	1.6%	1.6%
Finland	74.66	2%	2.6%	1.8%	1.6%	1.2%	1.2%
Sweden	99.40	3%	2.4%	2.2%	2.0%	2.0%	1.9%
Norway	117.18	4%	2.1%	2.1%	1.9%	1.9%	1.8%
Others Western Europe	148.36	5%	1.9%	1.8%	1.6%	1.6%	1.5%
USA	277.34	9%	2.9%	2.5%	1.8%	1.7%	1.5%
Others North America	31.40	1%	2.7%	2.5%	1.9%	1.8%	1.6%
						Weighted average	***1.80%***

Source: Own representation based on IMF (2018) and company data

3.4.2.4 Financial statements forecast

Table 10: WB forecasted income statement

Income Statement in € mil.	2014	2015	2016	2017	2018e	2019e	2020e	2021e	2022e
Revenues	2 834.47	2 972.36	2 973.83	3 119.71	3 230.77	3 327.04	3 416.26	3 498.72	3 574.72
Cost of goods sold	-1 983.75	-2 027.80	-2 011.24	-2 093.71	-2 196.93	-2 262.39	-2 357.22	-2 414.11	-2 502.30
Gross profit	**850.72**	**944.56**	**962.59**	**1 026.00**	**1 033.85**	**1 064.65**	**1 059.04**	**1 084.60**	**1 072.41**
Selling expenses	-548.06	-577.19	-574.35	-595.56	-617.19	-634.05	-649.91	-664.76	-678.62
Administrative expenses	-171.13	-182.66	-186.18	-203.32	-192.89	-195.65	-198.22	-200.59	-202.77
Other operating income	37.07	56.02	69.07	60.45	64.05	66.45	65.35	66.86	67.66
Other operating expenses	-333.67	-77.60	-80.56	-108.89	-92.19	-96.68	-101.91	-99.26	-101.44
EBITDA	**38.25**	**364.34**	**381.88**	**368.29**	**398.34**	**392.58**	**347.97**	**346.87**	**304.39**
EBITDA margin	**1%**	**12%**	**13%**	**12%**	**12%**	**12%**	**10%**	**10%**	**9%**
D&A	203.32	201.21	191.31	189.61	202.70	187.87	173.62	160.03	147.15
EBIT	**-165.07**	**163.13**	**190.57**	**178.68**	**195.63**	**204.72**	**174.35**	**186.85**	**157.24**
EBIT margin	**-6%**	**5%**	**6%**	**6%**	**6%**	**6%**	**5%**	**5%**	**4%**
Income from investments in associates and JVs	-2.76	4.01	6.67	4.21	4.21	4.21	4.21	4.21	4.21
Interest and similar income	8.12	6.80	5.49	5.95	5.95	5.95	5.95	5.95	5.95
Interest and similar expenses	-61.06	-49.09	-39.90	-42.10	-39.16	-41.02	-36.81	-47.26	-47.67
Other financial results	5.47	-17.83	-4.33	-1.85	-4.64	-4.64	-4.64	-4.64	-4.64
Financial results	-50.23	-56.11	-32.07	-33.79	-33.63	-35.49	-31.28	-41.73	-42.15
Profit/loss before tax	**-215.30**	**107.02**	**158.50**	**144.89**	162.00	169.22	143.07	145.11	115.09
Income taxes	-14.34	-37.20	-43.22	-4.24	-40.50	-42.31	-35.77	-36.28	-28.77
Profit/loss after tax	**-229.64**	**69.82**	**115.28**	**140.65**	121.50	126.92	107.30	108.84	86.32
Thereof attributable to non-controlling interests	-0.46	0.77	1.82	3.40	1.38	1.38	1.38	1.38	1.38
Thereof attributable to hybrid capital holders	32.50	32.50	31.54	14.06	32.50	32.50	32.50	32.50	32.50
Thereof attributable to equity holders	**-261.68**	**36.55**	**81.92**	**123.19**	87.62	93.03	73.42	74.95	52.44

Source: Own representation based on company data and thesis estimates

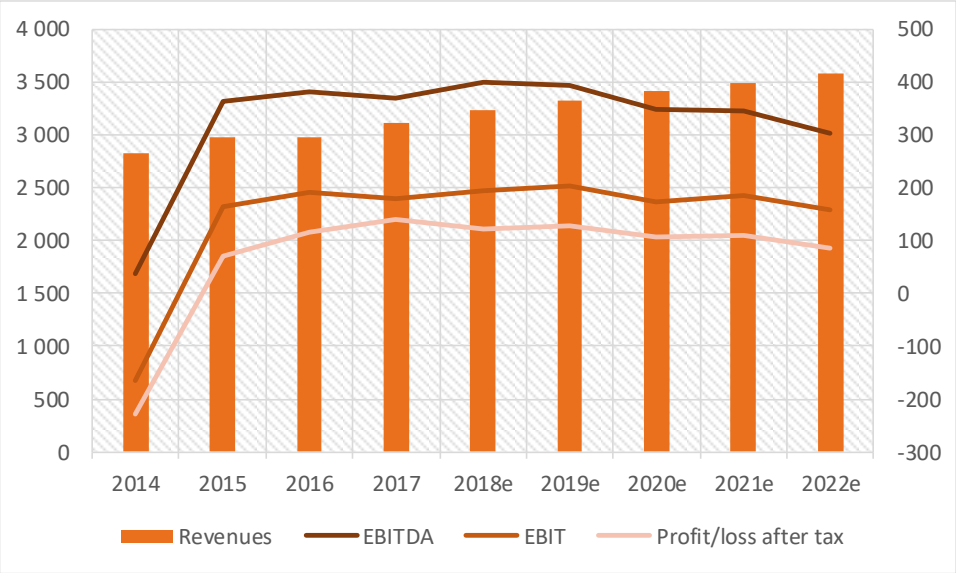
Other than revenue growth already discussed in the previous chapter, it is important to forecast other figures from income statement and balance sheet. The first step is to identify drivers and calculate historical ratios.[128] Some of them are intuitive such as costs of goods sold (COGS) which are linked with revenues since they are variable in this industry. There might be some fast-growing industries where revenues can grow faster than COGS but it is not the case here. Selling expenses are partially variable in nature so one part was linked with revenue growth while one part is fixed. Administrative expenses are almost completely fixed with a small percentage being driven by revenues.

Looking at historical data, 2014 seem to be a bad year for the company mostly due to other operating expenses related to some factories being shut down as the aftermath of the crisis. The period between 2015-2017 can be considered as normalized and looking

[128] Koller, Goedhart, & Wessels (2005), p.241

at EBITDA and EBIT margins projected, they are in line with this assumption. Result is slightly reduced in 2022 due to the assumptions of cyclicality (4-5 year cycle length). Financial expenses are estimated based on financing assumptions and historical averages.

Figure 17: Historical revenue and earnings development



Source: Own representation based on company data and thesis estimates

Table 11: WB forecasted balance sheet

Balance Sheet in € mil.	2014	2015	2016	2017	2018e	2019e	2020e	2021e	2022e
Assets									
Intangible assets and goodwill	694.81	701.43	690.44	690.90	703.8	703.8	705.4	710.0	715.0
Property, plant and equipment	1646.28	1614.87	1564.72	1521.57	1512.7	1524.5	1555.8	1605.7	1673.1
Investment property	76.68	91.61	85.73	65.92	61.8	94.7	87.4	81.3	92.0
Investments in associates and joint ventures	8.93	11.37	13.54	11.37	11.4	11.4	11.4	11.4	11.4
Other financial assets	12.26	11.78	13.91	16.71	16.5	18.0	18.0	18.0	18.0
Deferred tax assets	36.16	18.49	17.37	44.05	29.0	29.0	29.0	29.0	29.0
Non-current assets	**2475.11**	**2449.55**	**2385.71**	**2350.52**	**2335.2**	**2381.3**	**2407.0**	**2455.4**	**2538.4**
Inventories	701.40	753.27	718.36	741.60	790.9	814.5	848.6	869.1	900.8
Trade receivables	221.07	202.77	201.81	214.28	226.2	232.9	239.1	244.9	250.2
Receivables from current taxes	14.33	12.19	9.97	2.30	2.30	2.30	2.30	2.30	2.30
Other current receivables	81.96	60.55	66.29	98.93	98.9	98.9	98.9	98.9	98.9
Securities and other financial assets	61.91	58.43	52.74	79.00	79.0	79.0	79.0	79.0	79.0
Cash and cash equivalents	275.19	154.88	197.02	169.26	103.7	3.1	178.0	123.2	41.1
Current assets	**1355.86**	**1242.09**	**1246.19**	**1305.37**	**1298.7**	**1228.4**	**1443.7**	**1415.1**	**1370.0**
Non-current assets held for sale			**5.38**	**3.98**					
Total Assets	**3830.97**	**3691.64**	**3637.28**	**3659.87**	**3633.9**	**3609.7**	**3850.7**	**3870.5**	**3908.5**
Equity and Liabilities									
Issued capital	117.52	117.52	117.52	117.52	117.5	117.5	117.5	117.5	117.5
Share premium	1086.02	1086.02	1086.02	1086.02	1086.0	1086.0	1086.0	1086.0	1086.0
Hybrid capital	490.56	490.56	265.99	265.99	266.0	266.0	228.0	228.0	228.0
Retained earnings	516.17	546.75	586.96	674.92	733.5	793.8	845.4	883.0	904.1
Other Reserves	-236.19	-199.89	-222.50	-251.84	-251.8	-251.8	-251.8	-251.8	-251.8
Treasury stock	-4.86	-4.86	-4.86	-4.86	-4.9	-4.9	-4.9	-4.9	-4.9
Controlling interests	**1969.22**	**2036.11**	**1829.13**	**1887.75**	**1946.3**	**2006.6**	**2020.2**	**2057.9**	**2078.9**
Non-controlling interests	17.26	18.10	19.83	23.49	3.01	3.01	3.01	3.01	3.01
Equity	**1986.48**	**2054.21**	**1848.96**	**1911.24**	**1949.4**	**2009.7**	**2023.2**	**2060.9**	**2082.0**
Deferred tax liabilities	90.42	84.34	80.76	71.63	58.6	58.6	58.6	58.6	58.6
Employee-related provisions	151.67	160.58	171.49	154.99	159.7	159.7	159.7	159.7	159.7
Other non-current provisions	60.29	71.78	71.20	76.45	69.9	72.3	72.5	72.8	71.9
Long-term financial liabilities		507.53	481.43	493.95	494.0	400.0	600.0	600.0	600.0
Other non-current liabilities	3.74	4.34	4.00	6.02	5.6	5.6	5.6	5.6	5.6
Non-current provisions and liabilities	**306.12**	**828.57**	**808.88**	**803.04**	**787.8**	**696.3**	**896.4**	**896.7**	**895.8**
Current provisions	41.56	57.92	35.29	39.11	39.1	39.1	39.1	38.6	36.1
Payables for current taxes	8.18	11.70	15.91	11.40	0.0	0.0	0.0	0.0	0.0
Short-term financial liabilities	402.09	239.89	399.92	320.72	362.0	372.8	382.8	392.0	400.6
Trade payables	285.84	276.32	302.72	321.53	281.6	271.5	282.9	265.6	275.3
Other current liabilities	244.18	223.04	225.51	252.81	214.0	220.4	226.3	216.7	218.8
Current provisions and liabilities	**981.85**	**808.86**	**979.35**	**945.57**	**896.7**	**903.8**	**931.1**	**912.9**	**930.7**
Total Equity and Liabilities	**3274.44**	**3691.63**	**3637.19**	**3659.85**	**3633.9**	**3609.7**	**3850.7**	**3870.5**	**3908.5**

Source: Own representation based on company data and thesis estimates

3.4.2.5 Capex and depreciation

Capital expenditures represent the investment in long-term assets of the company under the assumption that these investments will generate revenues or they are needed to maintain current levels (maintenance CAPEX). They can be found under Property, Plant and Equipment in balance sheet or cash flow statement (PP&E). PPE is usually linked to revenues.[129] It can either be a historical percentage or higher in the future if higher investments in PPE are expected to maintain the growth.

On the other hand, depreciation is a noncash expense and it is the allocation of past expenditure to future time periods to match revenues and expenses.[130]

Depreciation can be estimated in relation to CAPEX or revenue.[131]

Table 12: Historical and forecasted CAPEX and Depreciation

	2014	2015	2016	2017	2018e	2019e	2020e	2021e	2022e
Total Net CAPEX	127.46	147.79	163.58	163.19	177.7	183.0	187.9	192.4	196.6
Revenues	2834.47	2972.36	2973.83	3119.71	3230.8	3327.0	3416.3	3498.7	3574.7
Capex/Revenues	4.5%	5.0%	5.5%	5.2%	5.5%	5.5%	5.5%	5.5%	5.5%
Depreciation	203.32	201.21	191.31	189.61	196.1	191.9	187.2	182.1	176.8
Dep/CAPEX	1.60	1.36	1.17	1.16	1.1	1.0	1.0	0.9	0.9
% change		-15%	-14%	-1%	-5%	-5%	-5%	-5%	-5%

Source: Own representation based on company data and thesis estimates

Capex historically is on average above 5% of revenues. Going forward, it is assumed that to facilitate growth, the company will invest more in PP&E which is justified by the fact that this is a capitally intense industry and growth should be fueled by investments.

Depreciation is a percentage of CAPEX. Historically it has been decreasing YoY, however, this level of reduction is estimated not to be realistic for new assets. Average depreciation decrease historically is 10% but for the forecasting horizon, it is assumed to be 5%. This is still keeping depreciation of around 100% of the CAPEX. In order to understand the decrease historically, contact with the company is needed. First thing that comes to mind is depreciation rates change.

[129] Koller, Goedhart, & Wessels (2005), p.249
[130] Higgins (2012), p.13
[131] Koller, Goedhart, & Wessels (2005), p.242

3.4.2.6 Working capital

Working capital is the reinvestment company needs in order to keep the operations running. Standard definition for working capital is simply the difference between current assets and current liabilities. However, for the valuation purposes this definition must be rewritten since some parts of assets or liabilities will be excluded and the rational will be provided.[132]

From the asset side, cash, cash equivalent and securities should be excluded since they can, and usually are invested in highly liquid interest-bearing assets. Accounts receivables should also be excluded since they are earning fair return and should be excluded. Inventories on the other hand do not so they are used to calculate the working capital needs together with other noncash current assets. This is why this measure is defined as noncash working capital.

On liabilities side, all interest-bearing debt should be excluded since it is already included in calculating cost of debt so it would be double counted.

Noncash working capital can either be estimated by linking it to revenues[133] or by estimating every line to forecast it. This thesis will use second approach since some of the lines are not linked with revenues.

Table 13: Historical and projected Noncash working capital

	2014	2015	2016	2017	2018e	2019e	2020e	2021e	2022e
Inventory	701.40	753.27	718.36	741.60	790.9	814.5	848.6	869.1	900.8
Other noncash current asset	379.27	333.94	330.81	394.51	406.4	413.1	419.4	425.1	430.5
Account payable	285.84	276.32	302.72	321.53	281.6	271.5	282.9	265.6	275.3
Other noninterest bearing current liabilities	293.92	292.65	276.71	303.32	253.1	259.5	265.4	255.3	254.9
Non-cash working capital	1660.43	1656.18	1628.60	1760.96	1732.0	1758.6	1816.2	1815.1	1861.4
% of revenues	24.7%	25.3%	24.2%	23.8%	24.5%	24.5%	24.8%	24.8%	25.2%

Source: Own representation based on company data and thesis estimates

Different approaches exist regarding the need and usefulness of estimating separate lines of working capital but the consensus is that that it is unnecessary in case forecast horizon is long. For the first five years, it is useful to go deeper into the analysis.[134]

[132] Damodaran (2002), p.261
[133] Koller, Goedhart, & Wessels (2005), p.247
[134] Damodaran (2002), p.261

In this case, both inventories and accounts payable are linked with COGS while non-cash current assets are linked with revenues in percentage terms. Rational for inventories and accounts payable is that they are related and driven by cost of production so it stands to reason that the main driver should be COGS. Same historical percentage of COGS or approximately 36% is used while accounts payable are approximately 12% assuming 2% improvement against historical numbers based on Company's announcements on more efficient cash flow conversion.

Increase in working capital will result in negative cash flows while reduction will result in positive cash flow since less capital is needed to run the operations.

3.4.2.7 Output of the WACC model

Once all the factors and financial statements are estimated, implied firm value can be calculated.

Table 14: Present value of the company's future cash flows

		1	2	3	4	5	5
	Year	2018	2019	2020	2021	2022	TV
+	(1-Tc)*EBIT	146.72	153.54	130.77	140.13	117.93	120.49
+	Dep & Am	185.81	172.21	159.15	146.69	134.89	
-	CAPEX	177.69	182.99	187.89	192.43	196.61	
-	Incr. NWC	-28.97	26.57	57.68	-1.16	46.35	
=	**FCF**	183.82	116.19	44.34	95.56	9.86	3 487.15
	WACC	5.08%	5.08%	5.08%	5.08%	5.08%	5.26%
	PV FCF	174.93	105.23	38.22	78.37	7.70	2 699.31

Source: Own representation based on company data and thesis estimates

First of all, future cash flows have to be discounted to present to find their present value. This will be the value of the firm and later, company's debt will be excluded. Again, as in dividend discount method, it is fairly obvious that majority of the value is coming from perpetual value and it is therefore very important to select proper growth rate and risk-free rate. Looking at the decreasing free cash flows, these are following the curve of the construction output for selected countries. As these are mainly developed countries,

current growth projections are fairly moderate to say the least. If the company will expand to other developing markets to hedge against this macroeconomic turn is something that was not contemplated in this thesis.

Terminal value formula used here is:[135]

$$Terminal\ value_t = Cash\ flow_{t+1}/(r - Stable\ growth) \quad (23)$$

So, applying this formula, terminal value is:

$$Terminal\ value_6 = \frac{120.5}{5.25\% - 1.8\%} = 3.487 \quad (24)$$

Regarding WACC, all the steps to estimate WACC variables are already described. Variables are:

Table 15: WACC components

	Forecast horizon	Terminal value
ERP	5.8%	5.8%
Beta	0.90	1.00
Rf	3.0%	3.0%
Cost of equity	8.2%	8.8%
D/E	43.0%	43.0%
E/C	30.0%	30.0%
Cost of debt	5.0%	5.0%
Tax rate	25.0%	25.0%
After tax CoD	3.2%	3.2%
D/C	70.0%	70.0%
WACC	**5.1%**	**5.3%**

Source: Own representation based on company data and thesis estimates

As already explained, beta is approaching 1 in terminal value so WACC is slightly increased since it was already close to 1 which is the case with mature companies. Marginal tax rate of 25% is used.

The final step is to deduct debt and cash from calculated firm value in order to have equity value and calculate the implied share price.

[135] Damodaran (2002), p.305

Table 16: Implied share price

Enterprise Value	3103.75
Net Debt	977.71[136]
Equity Value	2126.03
Shares Outstanding	117.53
Implied share Value	**18.09**

Source: Own representation based on company data and thesis estimates

Net debt is already discounting cash so implied equity value is BN 2.4 EUR and divided by the shares outstanding, gives an implied share value of 18.09 EUR comparing to a market price of 20.3 EUR.

Clearly, this is very different from the implied price calculated from dividend discount model. One of the reasons is definitely the payout ratio assumed in DDM model since growth rates for forecast horizon and terminal value are the same. This is a perfect example why the methods should converge in theory but in practice they do not.

Furthermore, comparing this implied share value with market price, it seems that WB is indeed overvalued but not as drastically as DDM method would imply and therefore, sell recommendation or potential no-buy recommendation might be exaggerated.

Since WACC method is built on many assumptions, it stands to reason to test those assumptions by performing sensitivity analysis on the share price. Main two drivers are terminal value growth and WACC discount percentage so by changing them, reasonable sensitivity analysis can be performed. The underlying hypothesis is that if potential investor is not convinced about the model, this is a good way to estimate how different the implied price is from the market price even under changed assumptions.

By changing these two main drivers, implied share price is:

Table 17:WACC Sensitivity analysis

Sensitivity analysis for implied share value today					
Change in percentage of WACC	Change in terminal growth				
	0.8%	1.3%	1.8%	2.3%	2.8%
3.1%	13.08	15.33	18.23	22.12	27.59
4.1%	13.00	15.26	18.16	22.05	27.51
5.1%	12.93	15.19	18.09	21.98	27.44
6.1%	12.87	15.12	18.02	21.91	27.38
7.1%	12.80	15.05	17.96	21.84	27.31

Source: Own representation based on company data and thesis estimates

[136] Already excluding cash

It is obvious from the table that the main driver is change in terminal growth. Even a small change such as 0.5% in growth rate is affecting the share price by between 2-6. This is a significant change when making investment decisions and it is the best indicator of how sensitive the model is. On the other hand, change in WACC does not influence the price change as much. Difference is around 0.20 EUR on the share price. This is one of the main arguments against the DCF methods that majority of the value is coming from the period beyond the forecast and it is dependent on one variable. This can be argued differently. This can mean that the value is in potential new projects or R&D that will start bringing value only after year 5.[137]

3.5 Relative valuation – facts and methods

Previous chapters explained how to perform a deep analysis of the company's risk, growth and cash flows. It required a lot of assumptions and business understanding. On the other hand, relative valuation is not a method that is aiming to provide intrinsic value. Relative valuation is measuring the value of the company in relation to comparable companies or the industry. Relative valuation will provide a value relative to some comparison and it will not try to find the true value of the company.

This method starts by identifying a group of comparable companies called the peer group. These companies should be comparable but comparable how? First of all, should they be in the same industry? This on its own is hard to achieve since many companies are diversified and are in different industries at the same time. The idea is to have similar risks and cash flow drivers so this would mean that comparable companies can be in different industries.[138] Next chapter will provide the peer group for WB.

Relative valuation or multiples valuation (since it based on multiples), has advantages and disadvantages. Advantages are that it is fairly simpler and less time consuming than DCF methods. Furthermore, it requires less assumptions and it is simpler to explain to potential investors. However, there are disadvantages as well. Since it is esti-

[137] Koller, Goedhart, & Wessels (2005), p.284
[138] Damodaran (2002), p.462

mating the value relative to the peer group, if the peer group is under or overvalued, the company will be as well.

Multiples valuation is usually misunderstood and misused. Any valuation can be justified using proper multiples and proper peer group. Multiples should provide insights into why the company's earnings, operating cash flow or revenues are moving in the direction relative to the industry.[139] These insights can provide additional inputs for DCF valuation and improve assumptions or relative valuation can be used to support DCF valuation and complement it although in practice, many acquisitions are measured only by multiples.

There are three common multiple types:[140]

a) Earnings multiples
b) Book value multiples
c) Revenue multiples

There are also sector specific multiples for certain temporary sectors to be valued but it is important to know that these cannot be used for other sectors or companies that are only partially involved in this particular sector for which the multiple is built.

3.5.1 Peer group

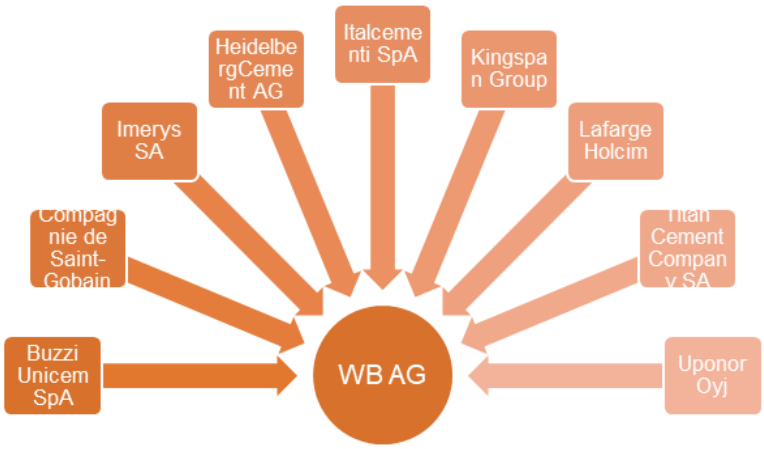
As mentioned in the previous chapter, a peer group should be a group of comparable companies. These companies should have similar risks, revenues, operating cash flow and earnings. Needless to say, these companies should be publicly traded in order for relative valuation to be possible. In reality, investment banks have the data on previous transactions in which they had the information about the companies being acquired or sold and this is providing them with the insights into financial statements. This implies that these banks can have the data about multiples in non-traded companies and they can use it as a guidance. Furthermore, these banks once hired by companies have the

[139] Koller, Goedhart, & Wessels (2005), p.371
[140] Damodaran (2002), p.454-455

insights into financials even those same companies that are not publicly traded which further down the line gives them the option to value the businesses using multiples.

The peer group selected for WB is below. The optimal number of companies is five and even though adding more companies will add more information but it might as well add more noise.[141] These companies are chosen based on the industry, business models or financials. All relevant data about them is from Yahoo finance/Morningstar.

Figure 18: WB Peer Group



Source: Own representation

3.5.2 Enterprise value multiples

First group of multiples are earnings multiples. Most common and most known is P/E multiple. However, P/E multiple is significantly affected by capital structure and net income is usually calculated after nonoperating gains or losses which can either overstate or understate the multiple.[142] Damodaran suggests using EV/EBITDA. Reasons are that fewer companies have negative EBITDA, which would exclude them from the group and this earnings measure is disregarding depreciation. Since some companies might use straight line depreciation while other can use accelerated one, this multiple is not affected by these decisions.[143] On top of it all, this multiple is not affected by the leverage.

Peer group EV/EBITDA:

[141] Cooper & Cordeiro (2008), p.14
[142] Koller, Goedhart, & Wessels (2005), p.371
[143] Damodaran (2002), p.501

Table 18: Peer group EV/EBITDA

Company	EV	EBITDA	EV/EBITDA
Buzzi Unicem SpA	4.10	0.53	7.77
Compagnie de Saint-Gobain	27.05	4.13	6.55
CRH	33.15	3.64	9.11
HeidelbergCement AG	22.47	2.74	8.20
LafargeHolcim	49.95	6.22	8.03
Imerys SA	6.88	0.91	7.53
Kingspan Group	7.74	0.47	16.57
Uponor Oyj	0.98	0.14	7.05
Titan Cement Company SA	2.32	0.24	9.75
		Median	***8.03***

Source: Own representation based on Morning star and Yahoo Finance

The reason median is used instead of average is to account for the effect of potential outliers such as Kingspan group with the16.57 multiple. Using this median, relative value compared to this group can be estimated. WB EBITDA is multiplied with the multiple to reach firm value after which all the steps from FCFF equation should be repeated.

Table 19: Relative value of WB using EV/EBITDA

Median EV/EBITDA	8.03
EBITDA	381.45
Enterprise Value	3063.01
Net Debt	977.71
Equity Value	2085.29
Shares Outstanding	117.53
Implied share Value	**17.74**

Source: Own representation based on the table 16

This share value is very close to 18.09 EUR estimated using WACC method and complements the conclusion that the real value of the share is somewhat below the market price of 20.30 EUR. Next valuation will be performed using book value multiple.

3.5.3 Book value multiples

Another group of multiples commonly used is book value multiples.

There are again several advantages and disadvantages of this multiple.

Advantages are that book value provide a stable measure against market price, accounting standards make them comparable across companies in different markets as

countries and it is rare that the book value is negative so it is possible to compare firms even if they have negative earnings. This would render price to earnings multiples useless.

Disadvantages are that book values are affected by accounting decisions such as fixed or accelerated depreciation. This is also the case if different countries have different accounting standards. Furthermore, this multiple might be useless for companies without significant tangible assets such as service companies. Wienerberger AG on the other hand in not such company and owns significant tangible assets. Finally, it might be the case that the negative earnings might reduce book value to negative and in this case, the multiple will be negative as well.[144]

For book value, price to book value multiple will be used and here is the peer group estimate:

Table 20: Peer group PBV

Company	Market CAP	BV	Price to BV
Buzzi Unicem SpA	3.14	2.75	1.14
Compagnie de Saint-Gobain	17.60	18.92	0.93
CRH	23.82	17.51	1.36
HeidelbergCement AG	11.81	14.76	0.80
LafargeHolcim	27.50	26.44	1.04
Imerys SA	4.10	2.72	1.51
Kingspan Group	7.21	1.64	4.39
Uponor Oyj	0.69	0.27	2.57
Titan Cement Company SA	1.56	1.10	1.42
		Median	***1.36***

Source: Own representation based on Morning star and Yahoo Finance

Again, median is used to offset the outliers such as Uponor and LafargeHolcim. Multiplying the median with book value of equity, relative value of WB is:

[144] Damodaran (2002), p.512

Table 21: Relative value of WB using PBV

Median Price to BV	1.36
BV	1 949.36
Enterprise Value	2651.13
Net Debt	977.71
Equity Value	1673.41
Shares Outstanding	117.53
Implied share Value	**14.24**

Source: Own representation based on the table 18

Implied share value is 14.24 EUR which implies again that the company is overvalued with the market price of 20.30 EUR. Final valuation will be performed using revenue multiple.

3.5.4 Revenue multiples

As with other methods of valuation, revenue multiples have pros and cons. Biggest advantage are that this multiple is always positive unlike the previous two which makes it perfect for even troubled or young firms with negative EBITDA. Furthermore, revenues are far less impacted by accounting standards, depreciation methods or the different policies in different countries since revenues are hard to manipulate. Finally, revenues are less volatile than earnings even in cyclical companies where revenues tend to be relatively stable while earnings experience swings. The biggest disadvantage is the fact that the multiple can tell a story which is very optimistic since this it disregards everything below revenues which is very dangerous.[145]

Using price to sales:

[145] Damodaran (2002), p.543-544

Table 22: Peer group PS

Company	Market CAP	Sales	Price to Sales
Buzzi Unicem SpA	0.69	0.61	1.12
Compagnie de Saint-Gobain	17.60	40.93	0.43
CRH	23.82	29.41	0.81
HeidelbergCement AG	11.81	17.37	0.68
LafargeHolcim	27.50	26.13	1.05
Imerys SA	4.10	4.82	0.85
Kingspan Group	7.21	3.94	1.83
Uponor Oyj	0.69	1.20	0.57
Titan Cement Company SA	1.56	1.51	1.03
		Median	***0.85***

Source: Own representation based on Morning star and Yahoo Finance

Using the median, relative value is:

Table 23: Relative value of WB using PS

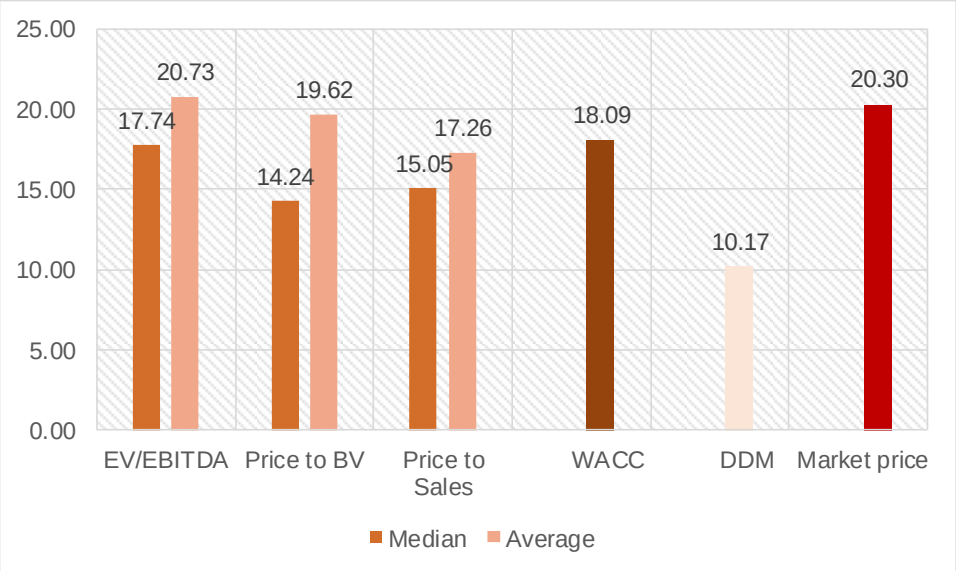
Median Price to sales	0.85
Sales	3 230.77
Enterprise Value	2746.16
Net Debt	977.71
Equity Value	1768.44
Shares Outstanding	117.53
Implied share Value	**15.05**

Source: Own representation based on the table 20

Final multiple is also valuing the share price as overvalued with 15.05 EUR against the share price of 20.30 EUR.

One final point important to mention and to show how sensitive multiples are is to use averages instead of medians for these three multiples:

Figure 19: Average versus median multiples impact on share price



Source: Own representation based on thesis estimates

Using averages instead of medians is increasing the implied share price and moving it closer to WACC estimated price. Only EV/EBITDA is implying that the stock is under-prices, while all other methods are implying that the stock is overpriced.

4 Conclusion

The aim of the thesis was to reconcile the theory behind main valuation models with the practice by applying them on real-life company.

First, detailed background about discounted cash flow and relative valuation was given. Discounted cash flow valuation method requires a lot of inputs to be calculated. Model used to calculate the cost of equity was CAPM. Risk free rate in the form of German 10-year bond yield proved to be too low to be used for a valuation of the company with perpetual value so US 10-year bond was considered as risk free. Growth rates are aligned with industry estimates for the horizon forecast and GDP growth for the terminal value since Wienerberger AG is a company highly affected by the cycles in the economy. Market risk premium was calculated taking into account geographical diversification of the company and beta was assessed using both a regression over an index as well as industry beta. Regarding dividends payout, historical figures were assumed to arrive to a value estimate for Dividend Discount Model. Cost of debt estimates showed that the company is maintain optimal capital structure with the debt-to-equity ratio of 43%. Since target capital structure has to be used for DCF valuation, this was considered. Finally, cost of debt was calculated over interest coverage and company ratings.

Regarding relative valuation, peer group of nine companies was chosen based on the profile of the company. Some of them are significantly larger than WB but they operate in same or similar industry and have similar operational risks.

Outcome of the valuation shows why it is not easy to objectively value a company. Significant driver of the DDM method is dividends payout. One of the main assumptions that had to be taken is how much would the company need to either invest and fund future growth or keep as a cash to hedge against potential financial distress seeing how the company is in a cyclical business. Downturn and 2008 crisis had a significant negative impact. With the assumptions of approximately 40% payout, company seems to be significantly overvalued. On the other hand, WACC method proved to be the most robust and it is a good tool to revise all aspects that can affect the value. The downside is that all these assumptions can also skew value since many of them are subjective. Fur-

thermore, one of the main drivers is the terminal growth rate. Although it is safe to assume that the company cannot grow at a high rate forever and that the economy grow will be a good estimate, how can an economy grow be estimated? International Monetary Fund or World Bank as main authorities in this field are shown to miss-forecast the growth. Looking at the sensitivity analysis of WB, 0.5% change can affect the price by 15-20%. Expectations about the CAPEX investments and depreciation are also quite subjective and are derived from the industry behavior but industries are being disrupted every day.

On the other hand, relative valuation will depend mainly on the choice for peer group. Value can be seen as the value relative to this group or relative to the industry, rather than the true value of the firm. It is proven that relative valuation is fairly simpler than DCF valuation. However, choice of multiples is important as well. Revenue multiples might give an optimistic value since they are disregarding everything below and in reality, the company can have negative earnings. Some earnings multiples can be useless if the company doesn't have positive earnings. Furthermore, it was seen that the choice between measuring the multiple as an average or median is highly material since the implied price can deviate up to 30% in price-to-book value multiple.

At the end, all methods are showing that the company's share price is overvalued. DDM is placing the lowest value with the share price of almost 10 EUR below the market. However, clear driver is the low dividend payout ratio and high cash keeping behavior. WACC method is also suggesting that the company is overvalued as well as all the multiples. Only one of them (EV/EBITDA) would show that the company is overvalued if measured as an average of the peer group which would amplify the effect of the outliers in the group. The conclusion is that the average investor with the information available publicly would decide not to buy this stock or sell it she owns it in the portfolio.

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Appendix

Abstract (English)

Valuation of companies and their assets was always one of the main topics in finance and industries that are buying and selling them were certainly one of the most attractive ones for finance professionals. Therefore, valuation methods and tools are thoroughly discussed and described in theory as well as tested in practice.

However, there was always a certain discrepancy between theoretical approach and its validity in the industry when real-life companies are valued. This thesis is explaining the theory behind main valuation models and applying them on an Austrian company Wienerberger AG, one of the industry leaders in construction materials. These methods are best used on brick-and-mortar businesses and Wienerberger AG is a prime example of this business model.

This thesis consists of 4 chapters: Chapter 1 gives a short introduction. Chapter 2 consist of a short concept description and comparison with the concept of price. Chapter 3 is the main chapter of the thesis where the theoretical approach is explained in detail using academic literature, and this approach is then tested on Wienerberger AG using actual company historical performance and projecting future one. This chapter will compare the outcome of the tool versus company's market price. Chapter 4 finalizes the thesis.

Abstract (Deutsch)

Die Unternehmensbewertung ist eine der Hauptthemen im Finanzbereich und dazu eine attraktive Disziplin für Finanzdienstleister. Demzufolge wurden bis dato sowohl in der Theorie als auch in der Praxis diverse Bewertungsmethoden und Instrumente gründlich erfasst und untersucht. Nichtsdestotrotz besteht eine gewisse Diskrepanz zwischen der Theorie und ihrer Validität bei der Bewertung realer Unternehmen in der Praxis.

Die vorliegende Masterarbeit gibt einen Überblick über die theoretischen Modelle und die Vorgehensweise bei einer Unternehmensbewertung und zeigt diese am praktischen Beispiel der österreichischen Firma Wienerberger AG, einem der Marktführer im Bereich von Baustoffmaterialien. Dieses Unternehmen wurde ausgewählt, da die untersuchten Modelle optimal für konventionelle Unternehmen geeignet sind und Wienerberger AG ein ausgezeichnetes Beispiel für ein solches Unternehmensmodell darstellt.

Die Arbeit gliedert sich in 4 Kapitel: Das erste Kapitel enthält eine kurze Einführung zum Thema. In Kapitel 2 wird das Konzept beschrieben und mit dem Preiskonzept verglichen. Im dritten Kapitel wird die theoretische Vorgehensweise mithilfe akademischer Literatur gründlich erklärt und am Beispiel der historischen Unternehmensleistung von Wienerberger AG getestet. Des Weiteren werden in diesem Kapitel die Ergebnisse des berechneten Modells mit dem tatsächlichen Aktienpreis des Unternehmens verglichen und eine Zukunftsprognose wird abgegeben. Zu guter Letzt liefert das letzte Kapitel eine ausführliche Schlussfolgerung.