
UNIVERSIDADE CATÓLICA PORTUGUESA

# Equity Valuation: Accounting for Value, Anchoring and Speculation

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by

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# Resumo

Os modelos tradicionais de avaliação de ações, como por exemplo o *Dividend Discount Model* e o *Discounted Cash Flow*, apresentam diversas limitações. Segundo Graham (1973), o principal problema destes modelos reside na incorporação de taxas de crescimento de longo-prazo, que os tornam demasiado especulativos. Recentemente, Penman (2006) procurou contornar este problema, tendo em consideração uma visão fundamentalista.

De acordo com esta visão, a avaliação deve-se, nos termos do autor, ancorar, no que efetivamente se sabe acerca do valor da empresa a avaliar, e separá-lo da especulação. Ora, se se deve fixar no que realmente se sabe acerca do valor, Penman (2006) advoga que essa âncora reside no valor contabilístico. Nesse contexto, o autor descreve um modelo de avaliação contabilístico, em particular um *Residual Income Model*, com pressupostos muito específicos, como o melhor modelo para debater esta problemática.

Assim sendo, o presente trabalho apresenta uma abordagem à objeção de Graham (1973) sob esta perspetiva de Penman (2006), resumindo-se à avaliação de um conjunto de empresas (no caso, uma amostra de empresas do DAX-30) com base no *Residual Income Model* e posteriormente à interpretação dos respetivos resultados de acordo com a teoria fundamentalista. Desta forma, pretende-se encontrar um valor âncora para as ações de cada empresa da amostra, e compará-lo com as percepções do mercado espelhadas no preço.

Deste modo, foram obtidos valores âncora (não especulativos) para as ações de 22 empresas do DAX-30, sendo que se verificou um número significativo de empresas com um valor âncora superior ao preço de mercado.

Palavras-chave: Avaliação de Ações; Contabilidade em Avaliação de Ações; *Residual Income Model;* Valor Âncora; Valor Especulativo.

# Abstract

The traditional stock valuation models, such as the Dividend Discount Model and the Discounted Cash Flow, present many limitations. According to Graham (1973), the main problem of these models lies in the incorporation of long-term growth rates, which in turn make them too speculative. Recently, Penman (2006) tried to finesse this problem, by considering a fundamentalist dictum.

This fundamentalist dictum tells that one must anchor on what is known from the value of a firm, and separate it from speculation. Well, if it is to anchor on what is known, Penman (2006) claims that one shall anchor on accounting. In this context, the author describes an accrual-accounting Residual Income Model, with very specific assumptions, as the best model to address this problem.

Thus, the present work provides an approach to the objection identified by Graham (1973), taking into account this perspective of Penman (2006), being summarized by the valuation of a set of firms (in this case, a sample of DAX-30 firms), based on the Residual Income Model, and an interpretation of the respective results according to the fundamentalist theory. Thereby, it is intended to find an anchor value for the shares of each sample firm and compare it with the market perceptions that are implicit in the share price.

There were obtained anchor values for the shares of 22 firms from the DAX-30, and there was a significative number of firms from the sample whose anchor share vaue (non-speculative) exceeded the market price.

Keywords: Equity Valuation; Accounting for Value; Residual Income Model; Anchoring; Speculation.

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# Notation

| | |
|---|---|
| AEG: | Abnormal Earnings Growth model |
| $\beta$: | Levered Beta (Systematic Risk) |
| $B_t$: | Book Value per Share on time t, in euro |
| DDM: | Dividend Discount Model |
| DCF: | Discounted Cash Flow |
| $DPS_t$: | Dividend per Share on time t, in euro |
| $EPS_t$: | Earnings per Share on time t, in euro |
| FY: | Financial Year |
| FCF: | Free Cash Flow |
| g: | Long-Term Growth Rate |
| MRP: | Market Risk Premium |
| $r_E$: | Cost of Equity |
| P/E: | Price-to-Earnings Ratio |
| Rf: | Risk-Free Rate |
| $RE_t$: | Residual Earnings per Share on time t, in euro |
| RIM: | Residual Income Model |
| $V_t$: | Stock Value on time t, in euro |

# Chapter 1
# Introduction

## 1.1 Relevance

In finance, equity valuation is the process of determining the fair market value of a stock. Valuation models come as "tools" of equity valuation, and define a firm's value based upon the expectations for its performance in the future. Thus, the Dividend Discount Model (DDM), for instance, determines value by the present value of future dividends the firm is expected to pay, and the Discounted Cash Flow, on another hand, determines value by the present value of future free cash flows the firm is expected to generate. These are two of the most traditional valuation methods, although presenting several limitations. In this context, Benjamin Graham (1973) states that the major problem of valuation models lies on the incorporation of long-term growth rates in valuation models, because they add to much speculation to valuation and consequently to value.

Graham's objection is approached by Stephen Penman (2006), who tries to finesse this problem by considering the fundamentalist dictum of anchoring on what is known from value and distinguishing it from speculation, stating that one shall anchor on accounting, "for accounting discovers what we know from a business". Thus, the author suggests that accrual-accounting may play an important role for addressing this problem and presents a Residual Income Model specification (an accrual-based valuation model) that, by following this dictum as rigorously as possible, provides an anchor valuation, i.e., a valuation with no speculation.

The present work provides an approach to Penman's (2006) research, focusing on the importance of accounting to valuation, including the features of the accrual-based Residual Income Model, and how can Graham's (1973) objection be handled. The project aims to provide an anchor value for the shares of the firm's composing the sample (22 firms of the DAX-30), based on accounting fundamentals, and discuss how to handle growth, and speculation, when valuing a firm, within Penman's (2006) perspective.

The anchor values were obtained based on a Penman's (2006) specific Residual Income Model and were compared to the market price. There were more firms whose share market price exceeded the anchors, although the number of firms in which the opposite happened was almost the same. There was also appointed a remark to the Residual Income Model. For firms who present high book values when compared to earnings, the residual earnings tend to be negative, therefore the model is not the most appropriate one.

By focusing on the relationship between accounting numbers and value, and by defining an anchor share value based on accounting, the analysis presented in this work presents an important contribution for both accounting and valuation research.

## 1.2 Research Questions

The defined research questions of the present work were based on the review of accounting and valuation research. Thus, there were two main questions formulated:

i) How can accounting be relevant to valuation and how do accounting numbers relate to value?

ii) Does the anchor valuation proposed by Penman (2006) really provide an anchor value?

This project will attempt to reach the answer to these questions by focusing on the importance accounting may have to valuation and by applying Penman's (2006) perspective to a determined sample.

## 1.3 Structure

Besides this introduction, the present work is divided into 4 more chapters.

The second chapter corresponds to the Literature Review, where is presented a theoretical overview to previous research regarding the main subjects of this work. It will focus on three main subjects: firstly, the importance of accounting for valuation purposes; secondly, the comparison of the traditional Dividend Discount Model and Discounted Cash Flow with the Residual Income Model; thirdly, the "anchoring and speculation" approach.

The third chapter describes in detail the methodology used for the present work, in particular, the data and sample collection and the chosen model application.

Fourth chapter presents the results obtained with the model described on chapter 3 and a qualitative analysis within Penman's (2006) perspective. In the end of the chapter, the formulated research questions are discussed within the obtained results.

Finally, on the fifth chapter are presented the main conclusions, work's limitations and recommendations for further research.

# Chapter 2
Literature Review

## 2.1 Fundamental Analysis, Accounting and Equity Valuation

According to Wafi et al. (2015, pp. 939-940), fundamental analysis is the "knowledge of the rules and fixed steps access to its objectives of determining the intrinsic value of shares in stock markets, through a general framework to study the expected economic forecasts, leading to sectors which generate an increase in sales and profits, therefore measure strenght financial companies, efficiency of management and business opportunities based on historical financial statements and current conditions. Thus, determine the stock fair value, and then compare them to market values resulting from interactions of supply and demand, to identify investment opportunities". To sum up, it is the process of using existing information to determine the intrinsic value of a share and compare it to the market price, thus indicating if it is overvalued or undervalued to identify investment opportunities.

### 2.1.1 Accounting for Value

In the last years, especially since the 1990s, the importance of accounting for value has become a central theme in the accounting and valuation research. These studies have been focusing particularly on the value relevance of accounting and the use of accruals in valuation, aiming to clarify the relationship between accounting numbers and value, and to improve valuation models using accruals. According to Lee (1999), the essential task of equity

valuation is forecasting (future cash-flows, dividends, earnings, among many other variables). Thus, the author affirms that the role of accounting in valuation is to help on estimating such parameters.

Penman (1992) provides a road map to fundamental analysis and accounting research, stating that the first step is to solve the fundamental problem of the dividend conundrum (price is based on future dividends but observed dividends do not tell anything about price), his objection to the Dividend Discount Model (DDM). The author suggests that accounting may play a role in providing an escape to this problem, emphasizing three important features of accounting:

i) It has the nominal attributes of a value measurement system (book values are presented as a measure of equity value and earnings as a measure of a change in that value);

ii) It is a disciplined system for reporting phenomena that is bound by rules that produce a value-added number independent of dividends (the calculation of earnings does not require dividends);

iii) It has a connection to future dividends once they are paid from postclosing book values.

These properties simply arise from the recognition of the accounting structure and do not compromise the valuation rules, being the base of the accrual-accounting based valuation models, such as Ohlson's (1995) and Feltham and Ohlson's (1995) Residual Income Model (RIM). The work of Penman (1992) demonstrates how and why these models were derived from the traditional DDM. The author also addresses Discounted Cash Flow (DCF) valuation, the standard of modern finance, referring it as "another conundrum". Value can be expressed as the present value of future cash flows, but observed cash flows are uninformative about value, reason why DCF cannot provide the escape from the dividend problem. Accounting, on the other

hand, solves the conundrum by separating wealth generation from dividends, and adjusting for financing through the per-share calculation.

In the period that followed, and in the same direction, many were the authors presenting significant contributions and improvements in accounting and valuation literature.

Dechow (1994) develops cross-sectional predictions about the hypothesis of accounting accruals providing a measure of short-term performance that better reflects expected cash flows than the realized ones do. Her results were consistent with this prediction.

Ohlson (1995) and Feltham and Ohlson (1995) present a benchmark of how market value relates to accounting information, the RIM model. Assuming the clean surplus accounting relation and specific linear information dynamics (these concepts will be clarified later), the authors define equity value as a linear function of earnings and book value. Their work has been significantly recognized and appreciated among many authors (e.g. Dechow et al., 1999; Lee et al., 1999; Jiang and Lee, 2005; Penman, 2006; Wells et al., 2008), having one of the greatest contributions to accounting and valuation research so far

Zhang (2000) develops a theoretical model to reexamine the roles of earnings and book value for equity valuation, adding endogenous investment decisions to Feltham and Ohlson's (1995) studies. The model shows that, although earnings and book value are key accounting variables for value determination, with endogenous investment decisions this relationship is non-linear: for any given book value, equity value increases with earnings; given earnings, equity value is expected to increase with book value for low-efficiency firms, be insensitive to book value for steady-state firms and decrease with book value for growth-firms. Zhang's (2000, p. 293) studies conclude that the relative explanatory power of earnings versus book value regarding equity value depends on operating efficiency and growth potential – "For low-efficiency

firms, book value is predicted to dominate earnings, while for steady-state firms, earnings are predicted to dominate book value. For growth firms, earnings and book value together explain equity value, and the usefulness of book value increases with the magnitude of the growth potential."

In the same line, El-Gazzar et al. (2006) examine the impact of earnings and book value on stock price valuation over the airline industry. Their studies provide evidence of a complementary explanatory power of earnings relatively to book value. Also, Damodaran (2007) highlights that, while few studies report that book value is a good measure for true value, there are many approaches that build value based not only on book value but also on accrual earnings. This emphasizes again the importance of accrual accounting, and the combination of book value and accrual earnings, on determining value.

Subramanyam and Venkatachalam (2007) examine the relative importance of earnings and operating cash flows in equity valuation, using *ex-post* intrinsic value of equity as criterion of comparison. Their findings indicate that accrual-based earnings outperform operating cash flows as an indicator of *ex post* intrinsic value.

Khanna (2014) analyses value relevance of accounting information produced by selected Indian firms and changes over a period of 4 years (from 2006 to 2010) and finds that accounting information is value relevant for BSE-listed firms. Value relevance can be defined, according to Kargin (2013), as "the ability of information disclosed by financial statements to capture and summarize firm value." Khanna (2014) denotes that many previous studies have examined value relevance of earnings, book values and cash flows, and have reported that earnings and book values have significant information content for a firm's equity valuation, meaning that his findigs are consistent with previous research.

### 2.1.2 Cash Accounting and Accrual Accounting Based Models

Many authors claim that cash accounting and accrual accounting based models should yield the same estimates, despite their differences.

Penman and Sougiannis (1998) compared valuations based on DDM, DCF and RIM. The obtained values were compared posteriorly with actual trade prices to calculate valuation errors (the authors used market price as value benchmarks, meaning that market efficiency was assumed). Their research recognizes that the valuation using different models is the same for an infinite horizon forecast. However, for finite horizon forecasts, Penman and Sougiannis (1998) demonstrate that the models yield different estimates and that accrual-based valuation methods outperform DDM and DCF. The authors denote that accrual accounting has the features of "bringing the cash flow forward in time to the present" and "dealing with the objections of cash flow forecasting" (351). Another important advantage appointed by Penman and Sougiannis (1998), when comparing accrual accounting based models with DCF, is that "accrual accounting removes the troubling investment in free cash flow and places it instead on the balance sheet as value to be realized in the future" (351). This is one of the main objections regarding DCF: investment should be treated as a positive component of value, and according to the model formula, investment decreases free cash flow (FCF) and so reduces value.

Francis et al. (2000) also compare RIM and DCF but instead of using ex post realizations, the authors use 5-years of Value Line estimates for the finite forecasting horizon. Their research supports Penman and Sougiannis (1998) results, concluding that "RI value estimates dominate value estimates based on free cash flow and dividends" (46). Courteau et al. (2000) studies also follow this line. In their research, they empirically test whether different valuation models yield the same estimates when a price-based terminal value calculation

is used. More specifically, the authors demonstrate that, by using Value Line's forecast of the future price to calculate terminal value, the models present identical estimates. The paper also presents a "horse race" between cash flow and residual income models using only forecasted financial statement data as input. Their final conclusion is that residual income outperforms cash flow when terminal price forecasts are not available.

Lundholm and O'Keefe (2001) examine why does previous research, namely the papers written by Penman and Sougiannis (1998), Francis et al. (2000) and Courteau et al. (2000), state that discounted cash flow and residual income valuations yield different estimates of equity value. Both methods are based on the same assumption (price equals the present value of expected future net dividends discounted at the cost of equity), therefore, the authors question why do they, in practice and as the literature tells, get different estimates. Their research shows how these models, properly implemented, get the same estimate for equity value. This equivalence implies that there is no superiority of one model over another. Lundholm and O'Keefe's (2001) argument is that prior research has applied inconsistent assumptions to DCF and RIM, denoting that these small errors cause huge differences on the final estimations.

Penman (2001) responds to Lundholm and O'Keefe's (2001) criticism, claiming that they dismiss recent research that demonstrates that accrual accounting residual income models and earnings capitalization models outperform, over certain conditions, cash flows and dividend discount models. The author also notes that the Lundholm and O'Keefe (2001) ignore many papers that provide evidence that GAAP (Generally Accepted Accounting Principles) accrual accounting has advantages over cash accounting.

### 2.1.3 A brief discussion on Valuation Models

This chapter describes the main characteristics of DDM, DCF and RIM and the advantages and disadvantages of each model appointed in the literature.

#### 2.1.3.1 The Dividend Discount Model

The DDM was originally idealized by Williams (1938) and defines stock value as the present value of expected future dividends. The most common valuation formula was derived by Gordon and Shapiro (1956) and reviewed by Gordon (1959), being known as the Gordon Growth Model. The model had a crucial contribution in valuation research once many other valuation methods, such as the RIM and DCF, for example, derive from its transformation.

Many financial economists believe that DDM provides a good estimate of stock market price, despite the numerous problems that have already been appointed to the model.

As stated before, Penman (1992) refers to its conundrum: value is based on future dividends but observable and paid dividends do not tell us anything about value. This is the main objection that the author points to the model.

Gode and Ohlson (2006) highlight two main disadvantages of the DDM. First, there are many growth companies that don't plan to pay dividends in the forecast horizon; second, unless Modigliani-Miller (1961) conditions are violated, dividend policy is irrelevant to value. Both weaknesses come from the same problem - the model isn't based on wealth generation but on its distribution. Penman (2006, p. 50) refers the same problem, claiming that "value is generated by trading with customers, not by paying dividends out of that value". The author gives the example of Cisco Systems, a firm that pays no dividends, despite valuable. One can forecast that dividend payments will be

zero in the future and be confident about this prospect, but it tells nothing about value. Moreover, Penman (2006) notes that, in DDM, we cannot anchor on what we know about value, considering the model too speculative.

Olweny (2011) tested the reliability of the DDM on the valuation of common stocks at the Nairobi Stock Exchange. The author predicted the price using the model and calculated the difference between his results and the effective market price. Based on a t-Test applied to this difference, he concluded that DDM is not reliable to forecast value, for this sample. Olweny (2011) states that his results are justified by, among other factors, the NSE market inefficiency, innapropriate discount factors, information differentials and measurement and evaluation problems. Wafi et al. (2015) also point to identical problems, claiming that the model lacks accuracy for the reason it requires financial market efficiency.

Although it is the base of many models' derivation, DDM has been proved to be quite limited.

#### 2.1.3.2 The Discounted Cash Flow Model

In DCF, the value of a firm is defined by the present value of the free cash flows the firm is expected to generate in the future. As Damodaran (2001 p. 691) states, in the DCF valuation method "we estimate the value of any asset by discounting back the expected cash flows on that asset at a rate that reflects their riskiness." Despite some disadvantages appointed in the literature, the model has many qualities and is widely used.

Penman (2006) describes the model as too speculative. The author also notes that one of the biggest problems regarding DCF valuation relies on the fact that cash investment diminishes FCF. This doesn't make sense once investment generally adds value rather than reducing it, supporting this with the example

of a set of firms, like General Eletric, that have reported constantly negative cash flows because they are valuable firms with many investment opportunities. Furthermore, the model turns problematic when it brings the need of applying a growth rate to negative cash-flows.

Gode and Ohlson (2006) recognize DCF's qualities, particularly the fact that it values firm's ability to generate cash (and not its distribution, as in DDM). However, the authors point to three problems. First, it is hard to measure FCF when the separation between operating/investing and financing activities is not clear (how a deposit should be handled by a bank, for example). Second, the authors state that free cash flows do not match contemporaneously wealth generation (unlike earnings), claiming that wealth is not cash flow. As Gode and Ohlson (2006, p. 4) refer, "free cash flows are not wealth flows because wealth is more than just cash". Khanna (2014, p. 1) also reported this problem, based on the studies of Ohlson (1995), Barth et al. (1998) and Collins et al. (1999), addressing that "cash flows have severe matching and timing problems". The final problem identified by Gode and Ohlson (2006) regarding DCF relies on the fact that, by not matching simultaneously wealth generation (as earnings do), it turns difficult to forecast them directly.

Wafi et al. (2015), while referring to DCF, highlight the same problem appointed to DDM. Once it requires financial market efficiency, the model lacks accuracy.

Although in DCF value comes from wealth generation, unlike DDM, it still presents several problems that must be solved.

### 2.1.3.3 The Residual Income Model

The method applied in the present research relies on the Residual Income Model approach by Penman (2006), reason why an extended review of its theoretical basis has been considered essential for this work.

The RIM knows its routes on the works of Preinreich (1938), Edwards and Bell (1961), Peasnell (1981, 1982) and was formalized by Ohlson (1995) and Feltham and Ohlson (1995), who gave the main popularity to the model. In the last two decades, the model has been seriously recognized for its pratical advantages, although his outperformance over the other traditional models for valuation purposes is still not consensual. Therefore, this section provides the basis of the model and the main advantages and disadvantages that have been pointed out through out the past years.

Ohlson (1995) derives the model based on the following main assumptions: i) market value equals present value of expected future dividends; ii) the clean surplus relation holds; iii) dividend payment reduces book value, but has no impact on current earnings. The clean surplus relation (or clean surplus accounting) means that the variation of equity book value on a determined period corresponds to the difference between earnings and dividends on that same period. By combining these assumptions, the author defines the stock market value of a determined firm as the sum of its book value with expected future residual earnings discounted to the present. Here it is important to clarify the definition of residual earnings (also called abnormal earnings, or residual income), which can simply be described as earnings in excess of equity charge. The underlying idea of the model is that, to create shareholder's value, a firm must generate income in an amount that exceeds the required return by the investors. The model puts significant weight on accounting information to determine value and explains how equity value relates to accounting variables

such as book value and earnings, providing the benchmark referred in the above section.

Dechow et al. (1999) present an empirical research of this method. Their findings demonstrate how the model provides a useful framework for empirical research with three main reasons: i) it provides a unifying framework for a large number of previous 'ad hoc' valuation models using book value, earnings and short-term earnings forecast, highlighting the implicit assumptions of these previous models regarding the relationship between current accounting variables and future abnormal earnings; ii) the model provides a basic framework upon which prior research can build; iii) its focus on how future abnormal earnings relate to accounting is "heuristically appealing".

The studies of Lee et al. (1999) also had their contribution to RIM research. The authors compare the performance of different estimates of intrinsic value in the United States (between 1963 and 1996), developing a V (value) measure, and a V/P (value-to-price) multiple, computed through RIM model. Their study provides evidence regarding the outperformance of this measure relatively to the simple market multiples such as B/P (book-to-price), E/P (earnings-to-price) and D/P (dividends-to-price) in terms of tracking ability and predictive power for overall stock returns.

Jiang and Lee (2005) test the empirical validity of the RIM to explain volatile, dynamic stock price movements, given the failures of the conventional DDM. Their research finds that, for stock valuation, book value and accounting earnings, which act like complementary indicators of value, contain more useful information than dividends alone. Thus, the authors state that accounting-based RIM works better than the conventional DDM.

Penman (2006) presents the advantages of RIM based on the advantages of accrual accounting over cash accounting. Investments are placed on the balance sheet instead of being subtracted from earnings and accrual components of

income are recognized in earnings. This means that accrual accounting based models, and residual income models, value flows rather than cash flows. The author also refers that RIM has the appealing feature of anchoring on solid fundamental information, namely book value and short-term earnings.

The paper of Gode and Ohlson (2006) provides a theoretical framework that shows how the alternative vauation methods, such as the RIM, can be used instead of dividends. The authors affirm that book value is a comprehensive measure of firm's net wealth, defining it as wealth already generated by the firm, while the market premium expresses expectations that the firm will earn abnormal profit, or in other words, that the return on equity of the firm will exceed its cost of capital (the so called residual income). Gode and Ohlson (2006) also highlight that the model has the great advantage of, unlike FCF, being contemporaneously matched with wealth generation, by connecting the popular accounting metrics to value.

The studies of Wells et al. (2008), based on a sample of listed Australian firms, indicate that RIM provides a better fair falue estimate when compared do DDM and DCF. The authors also conclude that the model has advantages in that there is less need to forecast returns as far into the future and on allowing the use of relatively low growth rates to calculate terminal value, avoiding the need to estimate an expected long-term growth rate.

Wafi et al. (2015) denote that the best model for equity valuation, proved reliable and accurate on both emergent and developed markets, is the RIM. The best quality pointed out by the authors when comparing with the other models is that it doesn't require financial market efficiency on its application.

Although there are many recent papers appreciating the RIM, Lo and Lys (2000) studies point out several criticisms about previous research regarding the residual income model, finding and claiming that most studies implement it incorrectly. First, according to the authors, most of these studies do not incude

the Ohlson (1995) information dynamics and are little more than a test or implementation of the model. Additionally, the authors highlight that these previous works typically use levels data analysis, which in turn are likely to have biased slope coefficients, and whose regression $R^2$ are upwardly biased. Thus, Lo and Lys (2000) denote that many researchers assign more credit to the model than it really deserves. However, the authors state that the problems appointed are not a reason to abandon the model, noting that it needs to be improved.

Ohlson (2000, p. 2) also criticizes the model, identifying three main problems problems. Firstly, on a per share basis, clean surplus, a necessary condition assumed by Ohlson (1995) for the model formula to be valid, will not generally hold if there are expected changes in the number of shares outstanding. Secondly, an all equity approach does not work if the firm is planning to bring in new shareholders who provide a net benefit through capital contributions. Finally, the Generally Accepted Accounting Principles (GAAP) break clean surplus, once some capital contributions are not accounted for in market value terms. Ohlson (2001) also adds some points not appreciated in the literature. First, the author claims that it doesn't play a central, crucial role for the analysis, but the role of "condensing and streamlining" the analysis, having no effect on the substantive empirical conclusions. Second, he states that the "other information" concept in the RIM can bring in concrete empirical content if it is presumed that next-period expected earnings are observable.

Gode and Ohlson (2006) recognize that makes sense modern finance theory giving preference to the earnings per share parameter when compared to cash flows, for valuation purposes. However, they address some limitations of the RIM. In particular, the authors point that "the focus on book values is misplaced and out of touch with practice especially when accounting is

conservative", i.e., accounting that uses techniques that tend to underestimate financial performance (thus book values are lower than market values).

Jamin (2008) analyses investment strategies based on the residual income valuation method, implementing four different specifications of the RIM for German companies over a period between 1990 and 2002. His conclusions show that the residual income valuation performance is not much better than that of the simple ratios, which goes in contrast with the theoretical predictions.

Despite solving many of the problems underlying DCF and DDM, RIM presents several limitations as well. In my view, there is no such thing as a perfect model, for now, but I do believe research is going on the right direction and that accrual-based models and accounting itself may play quite a role in valuation.

#### 2.1.3.4 Recent research regarding Accounting-Based Valuation Models

Ohlson and Juettner-Nauroth (2005), traditionally assuming that price equals the present value of future dividends, develop a model that relates firm's share price to:

i) Next year expected EPS (defined as $EPS_1$);

ii) Short-term (FY-2 vs FY-1) growth in EPS (defined as $G_2$);

iii) Long-term (asymptotic) growth in EPS (defined as g);

iv) Cost-of-equity capital (defined as $r_E$).

The model, named the Abnormal Earnings Growth model (AEG), can be represented by the following expression (different notation than the authors'):

$$V_0 = EP_1 * \frac{1}{r_E}\left(\frac{G_2 - g}{r_E - g}\right),$$

where the short-term (FY-2 vs FY-1) is defined by

$$G_2 = \frac{EP_{\ 2} - EP_{\ 1}}{EP_{\ 1}} + r_E * \frac{DPS_1}{EPS_1},$$

and the long-term growth rate as

$$g = \frac{EP_{\ t+1} - EPS_t}{EPS_t}.$$

It is important to note that both growth rates differ from the payout of dividends but are still both dividend policy irrelevant. Dividend policy irrelevance is precisely the reason of this divergence, which the authors explain in their research with mathematical arguments.

Jennergren and Skogsvik (2007) explore the Ohlson's and Juettner-Nauroth's (2005) AEG, reformulating the model to focus on operating earnings and free cash flows instead of earnings and dividends. Their argument is that, in the original AEG model, earnings are rather general or generic, and dividend policy irrelevance only holds in a limited sense for the equity-level model. The value of the firm would then be defined by the sum of the discounted free cash flows, equal to capitalized operating earnings plus the present value of an infinite sequence of growth projects (each one valued by discounted economic value added), minus initial debt.

They also incorporate two exogenous interest rates, in particular the unlevered required rate of return on equity and the borrowing rate, including all equity-financing rates in the model (Ohlson and Juettner-Nauroth, 2005, only take into account the levered cost of equity). Jennergren and Skogsvik (2007) finally compare their valuation method in a firm-level perspective with an equity-level perspective, concluding that they are "more favorably inclined towards the firm-level model" and suggesting that it could be a "worthwhile application for the AEG model" (22).

The studies of Ohlson and Johannesson (2016) criticize RIM, claiming that the model lacks empirical support. The authors present a significant contribution to accounting research by developing a new model where value is determined only by earnings and earnings growth. More specifically, according to Ohlson and Johanneson (2016), equity value can be expressed by the sum of an anchor, defined by the normal forward price-to-earnings (P/E) ratio times forecasted earnings, with a premium equal to the discounted future "abnormal" earnings growth. The studies of Gao et al. (2016) complement their work with a large sample analysis, demonstrating that the model can be really useful for estimating firm value and the cost of equity.

## 2.2 Anchoring and Speculation in Valuation

This chapter presents an overview of the central theme of this project: the problem of speculative growth rates incorporated in valuation and its suggested resolve within the fundamentalist dictum of separating what is known from speculation to estimate a share fair value.

According to Graham (1973, pp. 315-316), "the concept of future prospects and particularly of continued growth in the future invites the application of formulas out of higher mathematics to establish the present value of the favored issues. But the combination of precise formulas with highly imprecise assumptions can be used to establish, or rather justify, pratically any value one wishes". Valuation models define value based on the prospects of a determined firm for the future. This implies the specification of a discount rate, that measures firm's risk and alows the user to discount the uncertain future to the present, and a continued long-term growth rate to calculate the terminal value. Graham's (1973) objection refers to the incorporation of these perpetual growth

rates, once they bring too much speculation to valuation and, consequently, to value.

Penman (2006) claims that valuation is a matter of handling uncertainty, what is accomplished by valuation models by specifying expected growth and discount rates to measure risk. Nevertheless, this is highly speculative, leading to Graham's (1973) objection, which the author tries to finesse, considering the fundamentalist dictum: "understand what you know, anchor to it, and separate it from speculation" (49). Penman (2006) breaks down a valuation model into three components, accordingly to the following expression:

$$\begin{aligned} Value_0 = \quad & (1)\ Value\ based\ on\ the\ present \\ & + (2)\ Value\ based\ on\ information\ about\ near-term\ prospects \\ & + (3)\ Value\ based\ on\ long-term\ prospects \end{aligned}$$

The author explains the difference between each component and claims that, if it is to anchor on something, it shall be anchored on the first two components, because one can be sure about the past and the present, and reasonably confident about the near-term future (which he assumes as two years). The third component is the speculative one. This break-down provides a summarized approach of how speculation can be separated from what is known from value.

After analyzing the traditional valuation models, particularly the DDM, the DCF and the RIM, he points out that only the last one incorporates the three components, concluding that the others are too speculative and that there is no content on them to anchor on. The author emphasizes the importance of accounting, once it discovers what is known about a business, denoting that accrual accounting methods, and residual income methods, are preferred to the cash accounting ones. The main reason is because accrual accounting "in

principle" brings value forward in time, while cash accounting defers it to the speculative future. The model in which Penman (2006) is based on, a RIM with a 2-years forecast for the short-term, can be expressed by the following formula:

$$V_0 = B_0 + \frac{RE_1}{1 + r_E} + \frac{1}{1 + r_E} * \frac{RE_2}{r_E - g}$$

By breaking down this model, the author confirms that it has all the components of value incorporated. Component (1) is the book value, component (2) is described by the forecast for the near-term residual earnings (assuming one can be confident about the 2-year earnings forecast), and speculation about the long-term, reflected on the continued growth rate g, defines component (3). Given this, it can be concluded that, through RIM, one can anchor on what is known from value and observable in the present, book value (anchoring on fundamental solid information), and on something one can be reasonably sure about, residual earnings forecast for the near-term, and separate it from speculation. Note that accounting is not always reliable and thus may not tell the truth about a determined business, but this problem won't be refined in the present project, though. It is important to underline that the works of Ohlson (1995) and Feltham and Ohlson (1995) have been of major importance for Penman's (2006).

Now it remains to explain how the author addresses growth. As it was said before, he attempts to "surround" the objection identified by Graham (1973) regarding long-term speculative growth rates in valuation. On practice, he avoids speculation on long-term growth by setting it equal as the economy historical average. By gathering all these components, as described in the model, one can obtain an anchor stock value. Next step is to challenge the market's perception on growth, which the author accomplishes by reverse engineering his RIM and comparing it to the market price, obtaining an implicit

growth on stock price, which precisely represents market's perception and prospect regarding growth. Penman's (2006) final step is to compare his prospects and results with the market. His conclusion is that, in valuation, "the right question is not what the "right" value is, but rather whether a model can help an investor understand what perceptions best explain the market price, and then compare those perceptions to his own" (Penman 2006, p. 55).

Gode and Ohlson (2006) also refer to the RIM's anchor, stating that it anchors valuation on book values (thus on the balance sheet) once it derives market value as book value plus a premium over book value for expected growth in book value. While Penman (2006) assumes that the model anchors on the past, present and near-term future, these authors only point to the anchor derives from the past and the present. On an accounting view, it can be understood that Penman (2006) anchors on the balance sheet and the income statement, by book values and earnings, respectively.

The work of Ohlson and Juettner-Nauroth (2005) presents a different model and thus a different anchor, defined as the present value of expected earnings per share for the 1-year near-term, substituting Penman's (2006) book value per share and anchoring solely on the income statement. In the same line, Ohlson and Joannesson (2016) provide the earnings and earnings growth model, where the anchor is the normal forward P/E ratio times forecasted earnings for the 1-year near-term, only anchoring on the income statement as well.

The present project will focus on Graham (1973) and Penman's (2006) perspective, reason why this section of the literature review is so important, once it describes the core of the method that will be better explained and applied in the next chapter. The main purpose is precisely to apply Penman's (2006) model and assumptions to the chosen sample and to interpret the results within his perspective and the fundamentalists' theory.

# Chapter 3
## Methodology

This chapter is divided by two sections and presents the method used in the present work. First section refers to the data collection process, describing the chosen sample and the sources used. Second section justifies the choice of the specific RIM method used and describes its application to the chosen sample.

## 3.1 Data and Sample

The chosen sample for this project is composed by 22 firms listed in the German Stock Index DAX-30. The index is constituted by 30 firms, but some had to be excluded. To simplify the valuation, German financial firms Allianz, Commerzbank, Deutsche Bank, Deutsche Börse and Munich Re were removed. E. On and RWE had to be excluded for presenting at the end of financial year 2016 negative equity and net income, respectively. Finally, company Vonovia was also taken out for being a merger of two real estate German firms, namely Deutsche Annington and Gagfah, in 2015, invalidating the use of its historical data for future financial forecasts, required for the valuation model.

Thus, the final sample is composed by the following 22 firms: Adidas, BASF, Bayer, Beiersdorf, BMW, Continental, Daimler, Deutsche Post, Deutsche Telekom, Fresenius Medical Care, Heidelberg Cement, Henkel, Infineon Technologies, K+S, Linde, Lufthansa, Merck, ProSiebenSat.1 Media, SAP, Siemens, Thyssen Krupp and Volkswagen.

The data was gathered from the sample firm's reported financial statements over the years 2012 to 2016 and from the Yahoo!Finance database. From the

financial statements, the following standard parameters on this type of analysis were collected for each firm composing the sample:

i) Total shareholder's equity (no minority interests neither preferred stock included);
ii) Net income attributable to shareholders (no minority interests neither preferred stock included);
iii) Dividends per common share;
iv) Average number of shares outstanding fully diluted.

Yahoo!Finance was used to extract the stock market price of each firm at January 1st, 2017, except for some companies that closed their 2016 fiscal year at September 30th, 2016. On these cases, it was extracted the price at this precise day.

## 3.2 Method

The method of the present work can be summarized by the analysis of the sample firms' stock values, based in the RIM approach under Penman's (2006) assumptions described in the literature review section. The results will be compared with the market prices and interpreted following the author's and the fundamentalists' perspective. This method was chosen for the simple reason that it serves the main purpose of this work: to explain equity value wthin Penman's perpective and considering the fundamentalist dictum of anchoring on what we know and separating it from speculation.

**RIM under Penman's (2006) assumptions**

To address the fundamentalist dictum, Penman (2006) chooses the RIM for a simple reason. The model covers all three components of value (already

described in the literature review) and anchors on solid fundamental information, provided by the accounting.

The author assumes a 2-years forecast horizon, defining the model by the following expression (on a per share basis):

$$(1) \qquad V_0 = B_0 + \frac{RE_1}{1+r_E} + \frac{1}{1+r_E} * \frac{RE_2}{r-g}$$

It is important to note that RIM provides itself an anchor based on book values, in contrast with the models presented by Ohlson and Juettner-Nauroth (2005) and Ohlson and Joannesson (2016), whose anchors are defined as $\frac{EPS_1}{r_E}$ and $forward\frac{P}{E} * EPS_1$, respectively. Under Penman's (2006) assumptions, though, the whole RIM model provides an anchor value. The author anchors not only on the present and the past, through book values, but also on the near-term future, through earnings (and residual earnings) forecast, anchoring not only on the balance sheet but also on the income statement. Additionally, even handling the long-term growth rate he avoids speculation, taking the fundamentalist dictum as rigorously as possible. This will be clarified while presenting the model assumptions.

Now proceeding to the the model application. The valuation moment (time zero, t=0) corresponds to the end of fiscal year 2016. For most of the sample companies, 2016 ended on the December 31st, with the exception of Infineon Technologies, Siemens and Thyssen Krupp, which closed the year on September 30th, in 2016. Thus, and reminding the reader, for these companies, instead of comparing the valuation with market price at the January 1st, 2017, it was compared with the market price at September 30th, in 2016.

Book value per share of each firm on time 0 was obtained by dividing shareholder's common equity (no minority interests neither preferred stock

included) by the weigthed average number of common shares outstanding (fully diluted), presented by each firm at the end of financial year 2016:

$$(2) \qquad B_0 = \frac{Shareholders\ Equit\ _0 - Preferred\ Stock_0}{Weighted\ Average\ No.\ of\ Common\ Share\ \ Outstading\ (Fully\ Diluted)}$$

Book value per share (t=0) calculation is explained on Table 4, Appendix 1.

Earnings per share on time 0 were computed by dividing net income attributable to shareholders also by the weighted average number of common shares outstanding (fully diluted), presented by each firm at the end of financial year 2016:

$$(3) \qquad EP\ _0 = \frac{Net\ Income\ Atrributable\ to\ Sharehlder\ _0}{Weighte\ \ Average\ No.\ of\ Common\ Shares\ Outstading\ (Fully\ Diluted)}$$

Earnings per share calculation (t=0) is explained on Table 5, Appendix 2.

A brief note about the the dilutive effects. As the reader can observe, the calculation of book value and earnings per share took into account the dilutive securities, once the denominator in the above formulas corresponds to the fully diluted weighted average number of common shares outstanding. Dilutive securities are securities that are not common stock but that can be converted to if the holder exercises the option (for example, convertible bonds). If these options are effectively exercised, the number of shares outstanding (and its weighted average) obviously increases and, consequently, book value and earnings per share decrease. Thus, on considering the dilutive effects, it was followed the most conservative scenario.

Book value per share on time 1 (i.e., at the end of financial year 2017) was forecasted through adding earnings per share at time 1 and subtracting dividends per common share at time 0 to book value at time 0:

(4) $B_1 = B_0 + EP_{\ 1} - DPS_0$

Book value per share (t=1) calculation is explained on Table 6, Appendix 3.

The short-term forecasts of earnings per share were based on a mean-reversion of historical data between 2012-2016. Thus, for companies that presented a negative variation, on average, was assumed a short-term annual growth rate of 0%; for companies that presented a positive variation, on average, above German economy, was assumed a short-term annual growth rate of 2,12%, equivalent to the average of the economy for the period between 2006 and 2016 (source: World Bank):

(5) $EPS_{t+1} = EPS_t$, if earnings average annual growth rate for 2012-2016 < 0,

or

(6) $EPS_{t+1} = EPS_t * (1 + Germany\ Average\ Annual\ Growth\ Rate)$, if earnings average annual growth rate for 2012-2016 > 2,12%.

(Note: there were no firms with an annual growth between 0 and 2,12%)

These forecasts are explained on Tables 7 and 8, Appendix 4.

To obtain the residual earnings per share at time t, the charge against book value of common equity (cost of equity times book value per common share) was subtracted to earnings per share:

(7) $RE_t = EP_{\ t} - r_E * B_{t-1}$

The residual earnings calculation is explained on Table 9, Appendix 5.

It is important to clarify the concept of Residual Earnings, which Penman (2006, p. 51) defines as "earnings in excess of a charge against the book value of common equity".

The Capital Asset Pricing Model (CAPM) was used to compute each firm's cost of equity, assuming Fernandez' (2017) market risk premium (MRP) of 5,7%, a risk-free rate of 0,73%, equivalent to Germany Government Bond 10-year yield (source: Bloomberg) and Damodaran's levered betas (according to the industry sector of each firm of the sample).

The CAPM application and Damodaran's levered betas are explained on Tables 10 and 11, Appendix 6.

Since the basis of Penman's and Graham's theory is "growth is mainly speculation", it was assumed a long-term growth rate equal to the average Germany's GDP annual growth rate over a 10 years period (2006-2016) of 2,12%, i.e., g=2,12% (source: World Bank) for all firms.

The Germany's GDP 10-year annual growth rate (note: GDP at current prices) is described on Table 12, Appendix 7.

Within the key assumptions presented, the RIM was applied to the sample composed by the 22 DAX firms at the end of financial year 2016. The valuation results, at the end of financial year 2016, are provided in the next chapter.

# Chapter 4
## Results and discussion

### 4.1 Results

Table 1 provides each firm's stock value, in euro, based on the model described on chapter 3, i.e., based on the RIM approach under Penman's (2006) assumptions (note: all values were rounded to the hundredths).

Table 1: Firms' stock values, based on the RIM approach at the end of financial year 2016

| Firm | $B_0$ | $RE_1$ | $RE_2$ | Cost of Equity, $r_e$ | Growth rate, g | $V_0$ |
|---|---|---|---|---|---|---|
| **Adidas** | 31,40 € | 3,29 € | 3,22 € | 5,75% | 2,12% | 118,25 € |
| **BASF** | 34,63 € | 1,16 € | 1,02 € | 9,39% | 2,12% | 48,55 € |
| **Bayer** | 36,44 € | 3,18 € | 3,11 € | 6,52% | 2,12% | 105,85 € |
| **Beiersdorf** | 20,53 € | 2,11 € | 2,05 € | 5,27% | 2,12% | 84,17 € |
| **BMW** | 65,67 € | 6,13 € | 5,99 € | 5,55% | 2,12% | 236,92 € |
| **Continental** | 71,35 € | 9,22 € | 8,81 € | 7,13% | 2,12% | 243,98 € |
| **Daimler** | 54,17 € | 5,13 € | 5,03 € | 5,55% | 2,12% | 198,10 € |
| **Deutsche Post** | 8,82 € | 1,57 € | 1,55 € | 6,51% | 2,12% | 43,39 € |
| **Deutsche Telekom** | 6,34 € | 0,17 € | 0,18 € | 6,67% | 2,12% | 10,22 € |
| **Fresenius Medical Care** | 33,50 € | 1,90 € | 1,80 € | 6,08% | 2,12% | 78,08 € |
| **Heidelberg Cement** | 83,37 € | -3,12 € | -3,22 € | 8,22% | 2,12% | 31,82 € |
| **Henkel** | 34,34 € | 2,22 € | 2,08 € | 7,56% | 2,12% | 72,00 € |
| **Infineon Technologies** | 4,45 € | 0,34 € | 0,32 € | 7,54% | 2,12% | 10,20 € |
| **K + S** | 23,78 € | -0,89 € | -0,93 € | 7,56% | 2,12% | 7,00 € |
| **Linde** | 78,37 € | 3,48 € | 3,37 € | 3,83% | 2,12% | 271,25 € |
| **Lufthansa** | 15,15 € | 2,81 € | 2,65 € | 7,13% | 2,12% | 67,22 € |
| **Merck** | 32,18 € | 1,73 € | 1,64 € | 6,52% | 2,12% | 68,75 € |
| **ProSiebenSat.1 Media** | 6,47 € | 1,37 € | 1,41 € | 7,68% | 2,12% | 31,22 € |
| **SAP** | 22,00 € | 1,53 € | 1,47 € | 7,15% | 2,12% | 50,63 € |
| **Siemens** | 41,73 € | 2,87 € | 2,72 € | 9,39% | 2,12% | 78,48 € |
| **ThyssenKrupp** | 3,71 € | 0,17 € | 0,14 € | 9,85% | 2,12% | 5,54 € |
| **Volkswagen** | 184,91 € | 0,20 € | -0,05 € | 5,55% | 2,12% | 183,73 € |

## 4.2 Discussion

This section presents a qualitative analysis of the results within Penman's (2006) and the fundamentalists' perspective. Thus, it explores the particularities of the described RIM approach and presents the analysis of the obtained stock values within the author's thoughts, considering the fundamentalist dictum of separating what is known about value from speculation. After a detailed explanation of what was made so far, the results will be compared to the market prices, which will lead to this work final conclusions. In the end of the section, it will be presented a brief discussion regarding the research questions that were formulated in the present work.

First, it will be explained within a theoretical basis what has been made so far. The Penman's (2006) RIM approach described above has the feature of addressing in a clear way the fundamentalist dictum and, under its particular assumptions, the whole model forecasts an anchor share value. Why? Firstly, it anchors on the past and the present through book value, which is observable in the present. Once again, it is important to note that accounting may not be telling the truth, so one cannot be one hundred per cent sure about this value. Secondly, it anchors on the near-term accrual earnings forecast (thus on residual earnings), by assuming that earnings annual growth would not exceed the economy growth and that one can be reasonably confident about the near-term. Finally, the long-term growth rate, Graham's (1973) objection, was also handled avoiding speculation, by assuming it equal to the historical average of Germany's GDP annual growth rate. Thus, it can be concluded that through this RIM approach under Penman's (2006) assumptions, this valuation has anchored on what is known from value and separated it from speculation.

The valuation of the sample can be broken down as Penman (2006) does. As stated in the literature review chapter, according to the author, value is

determined by three components: value based on the present (1), value based on information about near-term prospects (2) and value based on log-term prospects (3). Table 2 expresses the RIM valuation of the DAX-30 within Penman's (2006) value break-down.

Table 2: RIM Valuation Break-Down

| Firm | $B_0$ (1) | Present value of near-term RE (2) | Long-term growth (3) | $V_0$ |
|---|---|---|---|---|
| Adidas | 31,40 € | 52,94 € | 33,92 € | 118,25 € |
| BASF | 34,63 € | 9,61 € | 4,31 € | 48,55 € |
| Bayer | 36,44 € | 44,99 € | 24,43 € | 105,85 € |
| Beiersdorf | 20,53 € | 36,40 € | 27,24 € | 84,17 € |
| BMW | 65,67 € | 101,85 € | 69,40 € | 236,92 € |
| Continental | 71,35 € | 113,88 € | 58,75 € | 243,98 € |
| Daimler | 54,17 € | 85,98 € | 57,95 € | 198,10 € |
| Deutsche Post | 8,82 € | 22,71 € | 11,86 € | 43,39 € |
| Deutsche Telekom | 6,34 € | 2,71 € | 1,17 € | 10,22 € |
| Fresenius Medical Care | 33,50 € | 26,71 € | 17,87 € | 78,08 € |
| Heidelberg Cement | 83,37 € | - 41,17 € | - 10,39 € | 31,82 € |
| Henkel | 34,34 € | 24,49 € | 13,16 € | 72,00 € |
| Infineon Technologies | 4,45 € | 3,77 € | 1,98 € | 10,20 € |
| K+S | 23,78 € | - 12,92 € | - 3,86 € | 7,00 € |
| Linde | 78,37 € | 85,40 € | 107,47 € | 271,25 € |
| Lufthansa | 15,15 € | 33,99 € | 18,08 € | 67,22 € |
| Merck | 32,18 € | 22,60 € | 13,98 € | 68,75 € |
| ProSiebenSat.1 Media | 6,47 € | 18,32 € | 6,43 € | 31,22 € |
| SAP | 22,00 € | 18,72 € | 9,91 € | 50,63 € |
| Siemens | 41,73 € | 25,88 € | 10,88 € | 78,48 € |
| ThyssenKrupp | 3,71 € | 1,08 € | 0,74 € | 5,54 € |
| Volkswagen | 184,91 € | - 9,12 € | 7,93 € | 183,73 € |

It is important to note that in the second component (value based on information about the near-term prospects), the 2-year ahead residual earnings are capitalized as a perpetuity, i.e., with no growth (moving the speculative growth to the third component), as the following expression demonstrates:

$$\frac{RE_1}{(1+r_E)} + \frac{RE_2}{(1+r_E)} * \frac{1}{r_E}$$

Before proceeding to the comparison of the obtained values with the market, there is a remark regarding the particular case of companies Heidelberg

Cement, K+S and Volkswagen. For these firms, the value based on the information about near-term prospects is negative (which can be justified by the high book values, demonstrated on appendixes 1 and 3), implying that their book value per share is higher than total value per share. In these situations, the RIM is definitely not the best valuation method to apply.

**Challenging the Market**

As referred before, the market prices were collected from the Yahoo!Finance database in the end of financial year 2016. Besides their comparison with the obtained values, the RIM model was reverse engineered to obtain the growth rate implicit in the market price so that its expectations could be challenged. The comparison with the market is provided by Table 3.

Table 3: Comparison with the Market

| Firm | Value | | | | Market | | |
|---|---|---|---|---|---|---|---|
| | Value based on the present (1) | Value based on information about near-term prospects (2) | Near-term anchor equal to (1)+(2) | Total Value, $V_0$ | Share Price, € | Difference | Implied Growth |
| Adidas | 31,40 € | 52,94 € | 84,33 € | 118,25 € | 145,65 € | 27,40 € | 3,01% |
| BASF | 34,63 € | 9,61 € | 44,24 € | 48,55 € | 89,12 € | 40,57 € | 7,64% |
| Bayer | 36,44 € | 44,99 € | 81,43 € | 105,85 € | 102,30 € | -3,55 € | 1,87% |
| Beiersdorf | 20,53 € | 36,40 € | 56,93 € | 84,17 € | 81,94 € | -2,23 € | 2,00% |
| BMW | 65,67 € | 101,85 € | 167,53 € | 236,92 € | 84,17 € | -152,75 € | -39,19% |
| Continental | 71,35 € | 113,88 € | 185,23 € | 243,98 € | 180,70 € | -63,28 € | -1,03% |
| Daimler | 54,17 € | 85,98 € | 140,15 € | 198,10 € | 69,35 € | -128,75 € | -40,69% |
| Deutsche Post | 8,82 € | 22,71 € | 31,53 € | 43,39 € | 30,95 € | -12,44 € | -0,53% |
| Deutsche Telekom | 6,34 € | 2,71 € | 9,05 € | 10,22 € | 16,16 € | 5,94 € | 4,92% |
| Fresenius Medical Care | 33,50 € | 26,71 € | 60,21 € | 78,08 € | 75,29 € | -2,79 € | 1,84% |
| Heidelberg Cement | 83,37 € | -41,17 € | 42,20 € | 31,82 € | 89,14 € | 57,32 € | 42,60% |
| Henkel | 34,34 € | 24,49 € | 58,83 € | 72,00 € | 97,44 € | 25,44 € | 4,39% |
| Infineon Technologies | 4,45 € | 3,77 € | 8,22 € | 10,20 € | 16,35 € | 6,15 € | 5,00% |
| K+S | 23,78 € | -12,92 € | 10,86 € | 7,00 € | 23,44 € | 16,44 € | 184,95% |
| Linde | 78,37 € | 85,40 € | 163,77 € | 271,25 € | 150,45 € | -120,80 € | -0,90% |
| Lufthansa | 15,15 € | 33,99 € | 49,14 € | 67,22 € | 12,34 € | -54,88 € | 52,67% |
| Merck | 32,18 € | 22,60 € | 54,78 € | 68,75 € | 101,65 € | 32,90 € | 4,25% |
| ProSiebenSat.1 Media | 6,47 € | 18,32 € | 24,79 € | 31,22 € | 39,28 € | 8,06 € | 3,54% |
| SAP | 22,00 € | 18,72 € | 40,72 € | 50,63 € | 84,63 € | 34,00 € | 4,91% |
| Siemens | 41,73 € | 25,88 € | 67,60 € | 78,48 € | 103,45 € | 24,97 € | 5,19% |
| ThyssenKrupp | 3,71 € | 1,08 € | 4,79 € | 5,54 € | 21,09 € | 15,55 € | 9,10% |
| Volkswagen | 184,91 € | -9,12 € | 175,80 € | 183,73 € | 147,65 € | -36,08 € | 5,42% |

(Note: the "Difference" column provides the difference between the share market price and total value, $V_0$)

On Table 3, the firms presented on green are those whose market price exceeded the anchor values ($V_0$) provided by the RIM, in the end of financial year 2016 (overpriced when compared to the anchor). It is clearly observable that, for these cases, the market was expecting higher growth than the average of the economy, once the growth rate implicit on price exceeded the the historical average of the German economy of 2,12% (the non-speculative growth rate). This corresponds to the typical scenario where the market speculates on long-term growth.

On the opposite, the firms presented on red are those whose market price at the end of financial year 2016 was exceeded by the anchor values ($V_0$) based on the RIM (underpriced when compared to the anchor), meaning that the market was expecting a lower growth than the average of the economy. In other words, the historical average of the German economy of 2,12% (the non-speculative growth rate) exceeded the implicit growth rate on market price. These cases are not so common and may correspond to an overreaction of the market that may have occurred in the time of the valuation, making prices go down. An interesting curiousity in this sample is that the number of firms in which the market was expecting lower-growth than the historical average of the economy was almost the same as the number of firms in which the market was speculating.

Table 3 also includes a column that separates value components (1) and (2) from the speculative component (3), anchoring on value based on the present (and the past) and based on the information about the near-term prospects. The difference between the market price and the values displayed by this column corresponds to the total amount the market is charging on growth.

For the reasons described above, companies Heidelberg Cement, K+S and Volkswagen were not considered for the market comparison analysis.

A final remark regarding the particular case of Lufthansa. As the reader can observe, for this firm, the market's implied growth is equal to 52,67%, approximately, much higher than the average of the economy. Given this, a problematic question arises: how does the market expects higher growth than the average of the economy and still presents a share price (12,34€) much lower than the value obtained through RIM (67,22€)? The reason lies on the fact that the implicit growth rate in the market exceeds by far the cost of equity (discount rate), violating the perpetuity validity condition (growth rate cannot exceed the discount rate).

**Discussion on the Research Questions**

To remind the reader, the research questions defined in the beginning of the present work were the following:

i) How can accounting be relevant to valuation and how do accounting numbers relate to value?

ii) Does the anchor valuation proposed by Penman (2006) really provide an anchor value?

The first question can be approached by the RIM specified in this project and by the Penman's (2006) concept of an anchor based on accounting. As stated in the literature review and described in the chapters 3 and 4, the RIM provides a benchmark of how accounting numbers can be related to value, defining it by anchoring on the balance sheet, through book values, and adding "extra" value through future near-term and long-term expected earnings (and residual earnings), which come from the income statement. Additionally, within Penman's (2006) assumptions, the whole model provides an anchor share value based on the balance sheet and the income statement. Thus, one can conclude that accounting can be relevant for valuation by providing the information of

what is known about a firm. Through accounting, one can anchor on what is known and separate it from speculation.

The second question can be addressed by the comparison of the anchor values with the market price. As stated before, there were many firms from the sample whose market stock price was lower than the anchors. This lies on two possible justifications. Either the instrument presented by Penman really provides an anchor value and, for this case, it would be an investment opportunity where one should by the stock, or, in the opposite scenario, the anchor presented by the author does not provide an anchor value and thus one can not anchor a valuation on accounting.

# Chapter 5
## Conclusions

This work has provided an approach to Penman's (2006) research, considering the fundamentalist dictum of anchoring on what is known from value and separating it from speculation, attempting to finesse Graham's (1973) objection regarding the incorporation of long-term speculative growth rates in valuation models.

To follow the author's perspective, a set of 22 firms from the German Stock Index (DAX-30) was valued using his specific Residual Income Model. This valuation has anchored on book value per share (value based on the past and present), in the 2-year forecasted earnings (value based on the information about near-term prospects) and on the historical average of the German economy to handle long-term growth. Thus, the whole valuation has avoided speculation, providing a set of anchor share values.

The valuation has anchored on the balance sheet and the income statement. Thus, it has put significant weight on accounting, meaning that it played a key role to provide the anchor value.

Additionally, it was also appointed that, for firms with negative residual earnings, which can be related to the high book values when compared to earnings (the examples of Heidelberg Cement, K+S and Volkswagen), the Residual Income Model is not the best approach to value the firms.

The obtained anchors were compared with the market to get an understanding of its expectations regarding each firm's growth. To help the analysis, the model was reverse engineered to calculate the growth rates implicit in the market price. Typically, the market speculates on long-term growth (the market price is speculative), but for this sample, the number of

cases in which the anchor value exceeded the market price (having a lower implicit growth in the price than the historical average of the economy, the assumed non-speculative growth rate), almost reached the number of firms in which the market speculated on growth, which may question the anchor's credibility.

This work has an important contribution to accounting and valuation research. It presented an analysis that related accounting with value that demonstrates how one can anchor on accounting numbers to obtain a non-specultive share value.

There were recognized three main limitations to the present project. The first one, is that the data source is not the most reliable one. Bloomberg or Thomson Reuters databases, for instance, would certainly be more reliable thant the companies' reported financial statements and the Yahoo!Finance. The second limitation is that this research does not consider accounting quality and the impact the accounting standards may have in valuation based on the accruals. Thirdly, also a significant weakness of the present work is that it does not provide any kind of statistical evidence neither an econometrical analysis regarding the relationship between book values and earnings (and residual earnings) with equity value. Thus, it does not present any statistical "proof" that the anchor provided by Penman (2006) really is an anchor, which is important to answer the research question regarding the credibility of the author's anchor.

For further research, there are two reccomendations. Firstly, it is suggested a similar analysis that was made, although within Ohlson and Juettner-Nauroth's (2005) or Ohlson and Joanneson's (2016) studies. These papers provide different anchors than Penman's (2006), which shall be analysed, and the models they present claim to outperform Ohlson's (1995) and Felhtam and Ohlson's (1995) RIM. Finally, as said before, the lack of statistical evidence comes as a great

limitation thus it is suggested for the future a statistical analysis that may complement the present work.

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# Appendix 1. Firms' Book Values per Share at the end of financial year 2016

Book value equals shareholder's equity divided by the weighted average number of shares. Thus, the following table presents each firm's shareholder's equity (no minority interests neither preferred stock included), weigthed average number of shares outstanding fully diluted and book value per share (rounded to the hundredths), at the end of financial year 2016.

Table 4: Book Values per Share at the end of financial year 2016

| Firm | Shareholder's Equity | Weighted Average No. Shares Fully Dilluted | $B_0$ |
|---|---|---|---|
| Adidas | 6.472.000.000,00 € | 206.146.908,00 | 31,40 € |
| BASF | 31.807.000.000,00 € | 918.478.694,00 | 34,63 € |
| Bayer | 30.333.000.000,00 € | 832.502.808,00 | 36,44 € |
| Beiersdorf | 4.656.000.000,00 € | 226.818.984,00 | 20,53 € |
| BMW | 43.155.638.800,00 € | 657.109.600,00 | 65,67 € |
| Continental | 14.270.000.000,00 € | 200.005.983,00 | 71,35 € |
| Daimler | 57.950.000.000,00 € | 1.069.800.000,00 | 54,17 € |
| Deutsche Post | 11.087.000.000,00 € | 1.257.325.283,00 | 8,82 € |
| Deutsche Telekom | 29.305.000.000,00 € | 4.625.000.000,00 | 6,34 € |
| Fresenius Medical Care | 10.258.847.760,06 € | 306.257.744,00 | 33,50 € |
| Heidelberg Cement | 16.093.100.000,00 € | 193.023.000,00 | 83,37 € |
| Henkel | 8.921.685.000,00 € | 259.795.875,00 | 34,34 € |
| Infineon Technologies | 5.023.000.000,00 € | 1.129.300.000,00 | 4,45 € |
| K + S | 4.550.700.000,00 € | 191.400.000,00 | 23,78 € |
| Linde | 14.577.000.000,00 € | 185.996.000,00 | 78,37 € |
| Lufthansa | 7.060.000.000,00 € | 465.936.921,00 | 15,15 € |
| Merck | 13.989.000.000,00 € | 434.777.878,00 | 32,18 € |
| ProSiebenSat.1 Media | 1.408.000.000,00 € | 217.652.018,00 | 6,47 € |
| SAP | 26.376.000.000,00 € | 1.199.000.000,00 | 22,00 € |
| Siemens | 34.211.000.000,00 € | 819.914.000,00 | 41,73 € |
| ThyssenKrupp | 2.102.000.000,00 € | 565.937.947,00 | 3,71 € |
| Volkswagen | 54.566.014.300,00 € | 295.089.818,00 | 184,91 € |

# Appendix 2. Firms' Earnings per Share on financial year 2016

Earnings per share (diluted) were calculated by net income attributable to shareholders divided by the weighted average number of shares outstanding fully diluted. Therefore, the following table provides firms' net income attributable to shareholders (no minority interests neither preferred stock included), weigthed average number of shares outstanding fully diluted and the diluted earnings per share (rounded to the hundredths), on financial year 2016.

Table 5: Diluted Earnings per Share on financial year 2016

| Firm | Net Income Attributable to Shareholders | Weighted Average No. Shares Fully Dilluted | Dil. EPS0 |
|---|---|---|---|
| Adidas | 1.028.000.000,00 € | 206.146.908,00 | 4,99 € |
| BASF | 4.056.000.000,00 € | 918.478.694,00 | 4,41 € |
| Bayer | 4.531.000.000,00 € | 832.502.808,00 | 5,44 € |
| Beiersdorf | 709.000.000,00 € | 226.818.984,00 | 3,13 € |
| BMW | 6.289.200.000,00 € | 657.109.600,00 | 9,57 € |
| Continental | 2.802.500.000,00 € | 200.005.983,00 | 14,01 € |
| Daimler | 8.526.000.000,00 € | 1.069.800.000,00 | 7,97 € |
| Deutsche Post | 2.644.000.000,00 € | 1.257.325.283,00 | 2,10 € |
| Deutsche Telekom | 2.675.000.000,00 € | 4.625.000.000,00 | 0,58 € |
| Fresenius Medical Care | 1.180.018.033,41 € | 306.257.744,00 | 3,85 € |
| Heidelberg Cement | 706.200.000,00 € | 193.023.000,00 | 3,66 € |
| Henkel | 1.226.000.000,00 € | 259.795.875,00 | 4,72 € |
| Infineon Technologies | 744.000.000,00 € | 1.129.300.000,00 | 0,66 € |
| K + S | 174.100.000,00 € | 191.400.000,00 | 0,91 € |
| Linde | 1.206.000.000,00 € | 185.996.000,00 | 6,48 € |
| Lufthansa | 1.776.000.000,00 € | 465.936.921,00 | 3,81 € |
| Merck | 1.629.000.000,00 € | 434.777.878,00 | 3,75 € |
| ProSiebenSat.1 Media | 397.000.000,00 € | 217.652.018,00 | 1,82 € |
| SAP | 3.646.000.000,00 € | 1.199.000.000,00 | 3,04 € |
| Siemens | 5.450.000.000,00 € | 819.914.000,00 | 6,65 € |
| ThyssenKrupp | 296.000.000,00 € | 565.937.947,00 | 0,52 € |
| Volkswagen | 3.021.000.000,00 € | 295.089.818,00 | 10,24 € |

# Appendix 3. 1-Year Book Values per Share forecast

Book value per share was calculated by adding diluted earnings per share forecasted for year 1 (2017) and subtracting dividends per common share on time 0 (end of financial year 2016) to book value per share on time 0. These parameters are described in the following table. Note: values rounded to the hundredths.

Table 6: Book Values per Share forecasted for year 1 (2017)

| Firm | $B_0$ | Dil. EPS1 | Dividend p/ common share | $B_1$ |
|---|---|---|---|---|
| Adidas | 31,40 € | 5,09 € | 2,00 € | 34,49 € |
| BASF | 34,63 € | 4,41 € | 3,00 € | 36,04 € |
| Bayer | 36,44 € | 5,56 € | 2,70 € | 39,29 € |
| Beiersdorf | 20,53 € | 3,19 € | 0,70 € | 23,02 € |
| BMW | 65,67 € | 9,77 € | 3,50 € | 71,95 € |
| Continental | 71,35 € | 14,31 € | 4,25 € | 81,41 € |
| Daimler | 54,17 € | 8,14 € | 3,25 € | 59,06 € |
| Deutsche Post | 8,82 € | 2,15 € | 1,05 € | 9,92 € |
| Deutsche Telekom | 6,34 € | 0,59 € | 0,60 € | 6,33 € |
| Fresenius Medical Care | 33,50 € | 3,93 € | 0,96 € | 36,47 € |
| Heidelberg Cement | 83,37 € | 3,74 € | 1,60 € | 85,51 € |
| Henkel | 34,34 € | 4,82 € | 1,62 € | 37,54 € |
| Infineon Technologies | 4,45 € | 0,67 € | 0,22 € | 4,90 € |
| K + S | 23,78 € | 0,91 € | 0,30 € | 24,39 € |
| Linde | 78,37 € | 6,48 € | 3,70 € | 81,16 € |
| Lufthansa | 15,15 € | 3,89 € | 0,50 € | 18,54 € |
| Merck | 32,18 € | 3,83 € | 1,20 € | 34,80 € |
| ProSiebenSat.1 Media | 6,47 € | 1,86 € | 1,90 € | 6,43 € |
| SAP | 22,00 € | 3,11 € | 1,25 € | 23,85 € |
| Siemens | 41,73 € | 6,79 € | 3,60 € | 44,91 € |
| ThyssenKrupp | 3,71 € | 0,53 € | 0,15 € | 4,10 € |
| Volkswagen | 184,91 € | 10,45 € | 2,00 € | 193,37 € |

# Appendix 4. Mean-Reversion applied to the Earnings per Share forecast

To forecast each firm's diluted earnings per share 2-years ahead (2017 and 2018) avoiding speculation, it was applied a mean-reversion. Thus, for firms' whose earnings per share variated negatively, on average and annually, between 2012 and 2016, it was assumed zero annual growth for the first 2 years forecast. For firms' whose earnings per share variated positively, on average and annually, between 2012 and 2016, it was assumed the average Germany GDP (at current prices) annual growth rate of the last 10 years (2,12%). The following tables clarify this procedure.

Table 7: Diluted Earnings per Share for 2012-2016

| Diluted Earnings p/Share | | | | | |
|---|---|---|---|---|---|
| **Company** | **2012** | **2013** | **2014** | **2015** | **2016** |
| Adidas | 3,78 € | 4,01 € | 2,35 € | 3,15 € | 4,99 € |
| BASF | 5,25 € | 5,27 € | 5,60 € | 4,33 € | 4,41 € |
| Bayer | 2,91 € | 3,86 € | 4,14 € | 4,97 € | 5,44 € |
| Beiersdorf | 1,96 € | 2,35 € | 2,33 € | 2,91 € | 3,13 € |
| BMW | 7,75 € | 8,10 € | 8,83 € | 9,70 € | 9,57 € |
| Continental | 9,53 € | 9,62 € | 11,88 € | 13,64 € | 14,01 € |
| Daimler | 6,02 € | 6,40 € | 6,51 € | 7,87 € | 7,97 € |
| Deutsche Post | 1,30 € | 1,66 € | 1,64 € | 1,22 € | 2,10 € |
| Deutsche Telekom | -1,24 € | 0,21 € | 0,65 € | 0,71 € | 0,58 € |
| Fresenius Medical Care | 2,93 € | 2,65 € | 2,84 € | 3,10 € | 3,85 € |
| Heidelberg Cement | 1,52 € | 3,98 € | 2,59 € | 4,26 € | 3,66 € |
| Henkel | 3,40 € | 3,65 € | 3,74 € | 4,42 € | 4,72 € |
| Infineon Technologies | 0,39 € | 0,25 € | 0,48 € | 0,56 € | 0,66 € |
| K + S | 3,48 € | 2,16 € | 1,99 € | 2,59 € | 0,91 € |
| Linde | 6,87 € | 7,08 € | 5,91 € | 6,18 € | 6,48 € |
| Lufthansa | 2,68 € | 0,68 € | 0,12 € | 3,67 € | 3,81 € |
| Merck | 2,61 € | 5,53 € | 2,66 € | 2,56 € | 3,75 € |
| ProSiebenSat.1 Media | 1,38 € | 1,45 € | 1,61 € | 1,81 € | 1,82 € |
| SAP | 2,35 € | 2,78 € | 2,74 € | 2,56 € | 3,04 € |
| Siemens | 4,69 € | 5,03 € | 6,31 € | 8,74 € | 6,65 € |
| ThyssenKrupp | -8,24 € | -2,71 € | 0,38 € | 0,55 € | 0,52 € |
| Volkswagen | 46,47 € | 18,69 € | 21,82 € | -3,20 € | 10,24 € |

Table 8: Diluted Earnings per Share annual growth (2013-2016) and Mean-Reversion

| Diluted Earnings p/ Share (annual growth) | | | | | | |
|---|---|---|---|---|---|---|
| **Company** | **2013** | **2014** | **2015** | **2016** | **Average** | **Mean Reversion** |
| Adidas | 6,08% | -41,40% | 34,04% | 58,31% | 14,26% | 2,12% |
| BASF | 0,38% | 6,26% | -22,68% | 1,76% | -3,57% | 0,00% |
| Bayer | 32,65% | 7,25% | 20,05% | 9,51% | 17,36% | 2,12% |
| Beiersdorf | 19,90% | -0,85% | 24,89% | 7,42% | 12,84% | 2,12% |
| BMW | 4,52% | 9,01% | 9,85% | -1,33% | 5,51% | 2,12% |
| Continental | 0,94% | 23,49% | 14,81% | 2,73% | 10,49% | 2,12% |
| Daimler | 6,24% | 1,72% | 20,89% | 1,27% | 7,53% | 2,12% |
| Deutsche Post | 27,69% | -1,20% | -25,61% | 72,37% | 18,31% | 2,12% |
| Deutsche Telekom | 116,94% | 209,52% | 9,23% | -18,54% | 79,29% | 2,12% |
| Fresenius Medical Care | -9,79% | 7,39% | 9,26% | 24,11% | 7,74% | 2,12% |
| Heidelberg Cement | 161,84% | -34,92% | 64,48% | -14,12% | 44,32% | 2,12% |
| Henkel | 7,35% | 2,47% | 18,18% | 6,77% | 8,69% | 2,12% |
| Infineon Technologies | -35,90% | 92,00% | 16,67% | 17,65% | 22,60% | 2,12% |
| K + S | -37,93% | -7,87% | 30,15% | -64,88% | -20,13% | 0,00% |
| Linde | 3,06% | -16,53% | 4,57% | 4,92% | -1,00% | 0,00% |
| Lufthansa | -74,63% | -82,35% | 2958,33% | 3,86% | 701,30% | 2,12% |
| Merck | 111,88% | -51,90% | -3,76% | 46,36% | 25,64% | 2,12% |
| ProSiebenSat.1 Media | 5,07% | 11,03% | 12,42% | 0,77% | 7,33% | 2,12% |
| SAP | 18,30% | -1,44% | -6,57% | 18,78% | 7,27% | 2,12% |
| Siemens | 7,25% | 25,45% | 38,51% | -23,95% | 11,82% | 2,12% |
| ThyssenKrupp | 67,11% | 114,02% | 44,74% | -4,90% | 55,24% | 2,12% |
| Volkswagen | -59,78% | 16,75% | -114,67% | 419,92% | 65,56% | 2,12% |

The mean-reversion column presents the annual growth rate that was applied to forecast earnings per share for the first 2 years. Note: All values were rounded to the hundredths.

# Appendix 5. Residual Earnings per Share forecast

After having forecasted each firm's diluted earnings per share for a 2-year horizon (for 2017 and 2018) and book value per share for year 1 (2017), and having computed the cost of equity, the residual earnings were calculated as the following expression demonstrates: $RE_t = EPS_t - r_E * B_{t-1}$

Next table provides the 2-year forecast residual earnings per share of each firm, rounded to the hundredths, in function of its parameters.

Table 9: Residual Earnings per Share forecasted for years 1 and 2

| Firm | Dil. $EPS_1$ | Dil. $EPS_2$ | $B_0$ | $B_1$ | $r_E$ | $RE_1$ | $RE_2$ |
|---|---|---|---|---|---|---|---|
| **Adidas** | 5,09 € | 5,20 € | 31,40 € | 34,49 € | 5,75% | 3,29 € | 3,22 € |
| **BASF** | 4,41 € | 4,41 € | 34,63 € | 36,04 € | 9,39% | 1,16 € | 1,02 € |
| **Bayer** | 5,56 € | 5,68 € | 36,44 € | 39,29 € | 6,52% | 3,18 € | 3,11 € |
| **Beiersdorf** | 3,19 € | 3,26 € | 20,53 € | 23,02 € | 5,27% | 2,11 € | 2,05 € |
| **BMW** | 9,77 € | 9,98 € | 65,67 € | 71,95 € | 5,55% | 6,13 € | 5,99 € |
| **Continental** | 14,31 € | 14,61 € | 71,35 € | 81,41 € | 7,13% | 9,22 € | 8,81 € |
| **Daimler** | 8,14 € | 8,31 € | 54,17 € | 59,06 € | 5,55% | 5,13 € | 5,03 € |
| **Deutsche Post** | 2,15 € | 2,19 € | 8,82 € | 9,92 € | 6,51% | 1,57 € | 1,55 € |
| **Deutsche Telekom** | 0,59 € | 0,60 € | 6,34 € | 6,33 € | 6,67% | 0,17 € | 0,18 € |
| **Fresenius Medical Care** | 3,93 € | 4,02 € | 33,50 € | 36,47 € | 6,08% | 1,90 € | 1,80 € |
| **Heidelberg Cement** | 3,74 € | 3,82 € | 83,37 € | 85,51 € | 8,22% | - 3,12 € | - 3,22 € |
| **Henkel** | 4,82 € | 4,92 € | 34,34 € | 37,54 € | 7,56% | 2,22 € | 2,08 € |
| **Infineon Technologies** | 0,67 € | 0,69 € | 4,45 € | 4,90 € | 7,54% | 0,34 € | 0,32 € |
| **K + S** | 0,91 € | 0,91 € | 23,78 € | 24,39 € | 7,56% | - 0,89 € | - 0,93 € |
| **Linde** | 6,48 € | 6,48 € | 78,37 € | 81,16 € | 3,83% | 3,48 € | 3,37 € |
| **Lufthansa** | 3,89 € | 3,97 € | 15,15 € | 18,54 € | 7,13% | 2,81 € | 2,65 € |
| **Merck** | 3,83 € | 3,91 € | 32,18 € | 34,80 € | 6,52% | 1,73 € | 1,64 € |
| **ProSiebenSat.1 Media** | 1,86 € | 1,90 € | 6,47 € | 6,43 € | 7,68% | 1,37 € | 1,41 € |
| **SAP** | 3,11 € | 3,17 € | 22,00 € | 23,85 € | 7,15% | 1,53 € | 1,47 € |
| **Siemens** | 6,79 € | 6,93 € | 41,73 € | 44,91 € | 9,39% | 2,87 € | 2,72 € |
| **ThyssenKrupp** | 0,53 € | 0,55 € | 3,71 € | 4,10 € | 9,85% | 0,17 € | 0,14 € |
| **Volkswagen** | 10,45 € | 10,68 € | 184,91 € | 193,37 € | 5,55% | 0,20 € | - 0,05 € |

# Appendix 6. CAPM and Cost of Equity

As described in the methodology, the cost of equity of each firm was calculated by applying the CAPM, assuming a risk-free rate correspondent to the 10-year German treasury bond (source: Bloomberg), Fernandez (2017) risk-premium and Damodaran Betas (which reflect systematic risk). The following tables provide the Damodaran Levered Betas for each firm, according to the respective industry, and the application of CAPM (: $r_E = rf + MRP * \beta$ ) to compute cost of equity.

Table 10: Damodaran Firms´ Levered Betas

| Company | Industry Name | Beta |
|---|---|---|
| Adidas | Apparel | 0,88 |
| BASF | Chemical (Diversified) | 1,52 |
| Bayer | Drugs (Pharmaceutical) | 1,02 |
| Beiersdorf | Household Products | 0,80 |
| BMW | Auto & Truck | 0,85 |
| Continental | Auto Parts | 1,12 |
| Daimler | Auto & Truck | 0,85 |
| Deutsche Post | Transportation | 1,01 |
| Deutsche Telekom | Telecom. Services | 1,04 |
| Fresenius Medical Care | Healthcare Support Services | 0,94 |
| Heidelberg Cement | Construction Supplies | 1,31 |
| Henkel | Chemical (Specialty) | 1,20 |
| Infineon Technologies | Semiconductor | 1,20 |
| K + S | Chemical (Specialty) | 1,20 |
| Linde | Power | 0,54 |
| Lufthansa | Air Transport | 1,12 |
| Merck | Drugs (Pharmaceutical) | 1,02 |
| ProSiebenSat.1 Media | Broadcasting | 1,22 |
| SAP | Software (System & Application) | 1,13 |
| Siemens | Chemical (Diversified) | 1,52 |
| ThyssenKrupp | Steel | 1,60 |
| Volkswagen | Auto & Truck | 0,85 |

Table 11: Cost of Equity

| Company | Risk Free Rate | Beta | Market Risk Premium | Cost of Equity |
|---|---|---|---|---|
| **Adidas** | 0,73% | 0,88 | 5,70% | 5,75% |
| **BASF** | 0,73% | 1,52 | 5,70% | 9,39% |
| **Bayer** | 0,73% | 1,02 | 5,70% | 6,52% |
| **Beiersdorf** | 0,73% | 0,80 | 5,70% | 5,27% |
| **BMW** | 0,73% | 0,85 | 5,70% | 5,55% |
| **Continental** | 0,73% | 1,12 | 5,70% | 7,13% |
| **Daimler** | 0,73% | 0,85 | 5,70% | 5,55% |
| **Deutsche Post** | 0,73% | 1,01 | 5,70% | 6,51% |
| **Deutsche Telekom** | 0,73% | 1,04 | 5,70% | 6,67% |
| **Fresenius Medical Care** | 0,73% | 0,94 | 5,70% | 6,08% |
| **Heidelberg Cement** | 0,73% | 1,31 | 5,70% | 8,22% |
| **Henkel** | 0,73% | 1,20 | 5,70% | 7,56% |
| **Infineon Technologies** | 0,73% | 1,20 | 5,70% | 7,54% |
| **K + S** | 0,73% | 1,20 | 5,70% | 7,56% |
| **Linde** | 0,73% | 0,54 | 5,70% | 3,83% |
| **Lufthansa** | 0,73% | 1,12 | 5,70% | 7,13% |
| **Merck** | 0,73% | 1,02 | 5,70% | 6,52% |
| **ProSiebenSat.1 Media** | 0,73% | 1,22 | 5,70% | 7,68% |
| **SAP** | 0,73% | 1,13 | 5,70% | 7,15% |
| **Siemens** | 0,73% | 1,52 | 5,70% | 9,39% |
| **ThyssenKrupp** | 0,73% | 1,60 | 5,70% | 9,85% |
| **Volkswagen** | 0,73% | 0,85 | 5,70% | 5,55% |

# Appendix 7. Germany's GDP 10-year annual growth

The following table provides the Germany's GDP (at current prices) annual growth for the period between 2006-2016 and the annual average, which was used to the mean reversion applied to the 2-year forecast earnings per share and assumed as the long-term growth rate in the RIM valuation (source: World Bank).

Table 12: Germany GDP Annual Growth for 2006-2016 (World Bank)

| Year | Germany GDP Annual Growth Rate (World Bank) |
|---|---|
| 2006 | 4,93% |
| 2007 | 14,57% |
| 2008 | 9,08% |
| 2009 | -8,91% |
| 2010 | -0,03% |
| 2011 | 9,97% |
| 2012 | -5,69% |
| 2013 | 5,88% |
| 2014 | 3,68% |
| 2015 | -13,24% |
| 2016 | 3,03% |
| **Average (10-years)** | **2,12%** |