

**Study on
German Valuation Practice**

**in Squeeze outs, Mergers and other Legal
Measures according to German Law
5th Edition Years 2010 - 2018**

Foreword

Squeeze-outs according to German Stock Corporation Law or German Merger Law as well as control and profit transfer agreements are significant interferences in the ownership and shareholder rights of minority shareholders. Therefore squeeze-outs and changes of the legal form of a Corporation pursuant to German Corporation Law require, that the minority shareholder is granted a fair and adequate payment compensating the loss of his ownership rights. In cases of control and profit transfer agreements besides the immediate compensation payment also an annual guarantee dividend has to be determined by the valuator. In almost all known cases German Certified Public Accountants (in German 'Wirtschaftsprüfer') prepared comprehensive valuation reports for the majority shareholder or the controlling enterprise. The valuations are then audited by a second German Public Accountant (the 'auditor') legally appointed by the respective district court. This two-tier procedure ensures the fairness and adequacy of the compensation payment. Only in five analyzed cases of this study the majority shareholder conducted the original valuation to determine the compensation.

After the shareholder resolution of the squeeze-out or the control and profit transfer agreement a standardized legal procedure (in German 'Spruchverfahren') follows, assessing the adequacy of the compensation by court, if demanded by the minority shareholders.

As valuations according German Stock Corporation or Merger Law are based on a range of approaches and valuation parameters, the purpose of this study is to give an overview and an analysis of current trends in the German legal valuation practice.

Detailed explanations of the theoretical backgrounds of the analyzed cases are purposely kept brief, as this study is made for professionals regularly involved with business valuations and transactions. The study intends to create transparency and to give an overview of the practice, not to judge or rate, as conventions do not equal best practice, especially as newer approaches or theoretical concepts of business valuation theory and corporate finance are put into practice.

This fifth edition of the study includes the 2018 valuations, among them major cases within the DAX and MDAX indexes. Moreover, we have included valuations in previous years that have been forwarded to us. As a growing number of valuers have extended management's detailed forecasts, the study was complemented with an analysis of forecast extensions and the basis for deriving the terminal value.

February 2019



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1 About this study and data collection

In this study we have analyzed the valuation in public management's reports about conclusions of control and profit transfer agreements, about the transfer of minority shares to the majority shareholder (squeeze-out of minority shareholders) according to section 327a et seqq. German Stock Corporation Act (AktG) or according to section 62 passage 5 German Reorganization of Companies Act (UmwG) as well as merger reports and expert appraisals on the change of the legal form according to section 207 UmwG concerning applied methods and approaches and assessed valuation parameters. As each of these structural measures according to the German stock corporation law creates an audit duty, each case also requires an audit report by German Certified Public Accountants.

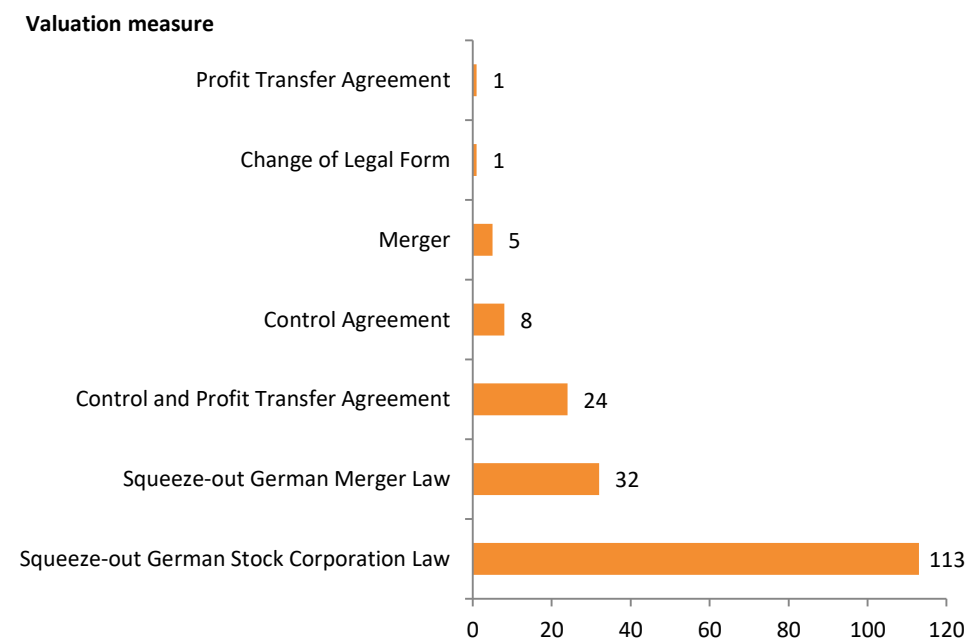
We did not intend to examine the jurisdiction concerning legal valuations in Germany. Expert reports within legal procedures and shareholder compensation claim challenges (Spruchverfahren according to the Spruchgesetz), legal verdicts or negotiated settlements have therefore not been included as many of those cases concern specific individual situations or valuation dates significantly before the year 2010.

The analysis of the study includes all valuations with valuation dates of the years 2010 until 2018. The years before 2009 were not analyzed in the study as the introduction of the German flat withholding tax rules on dividends and capital gains significantly changed the tax treatment of important valuation parameters. The study assesses the current state on German legal valuation practice and further ongoing developments in this field.

In this current fifth edition, all expert opinions and audit reports available to us were supplemented with a valuation date of 2018. The analyzed cases and audit reports are listed in annex no. 1 with the name of the valuation target and the initiating majority shareholder. All other known historic cases, where no valuation or audit reports have been publically available, are listed in annex no. 2 of the study. The study will be complemented, if readers provide these reports. In total 184 corporate valuation cases have been analyzed.

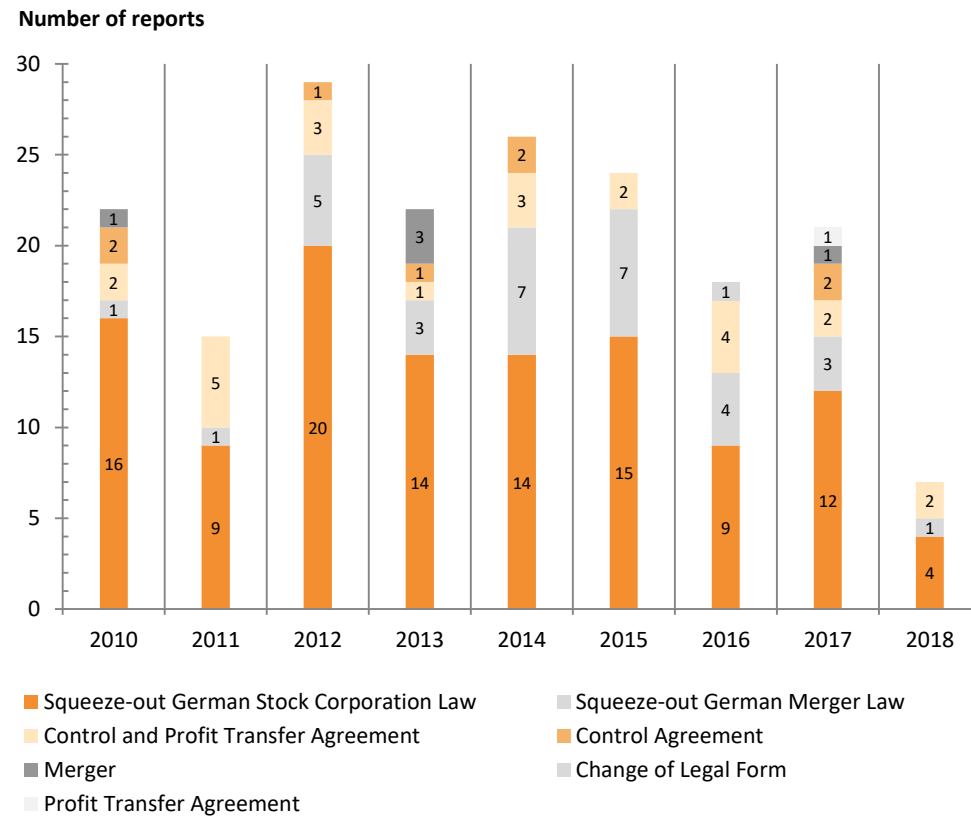
The majority of the valuations concern squeeze-outs according to German Stock Corporation law as the following chart illustrates:

Analyzed valuations of the years 2010 - 2018 according to transaction type



The following chart illustrates the development and numbers of analyzed valuation reports between the years 2010 and 2018:

Analyzed valuations in years 2010 - 2018 according to reason



Compared to 2017, there has been a significant decrease in the number of procedures from 21 to 7.

2 Valuation process and methods

Principles of applied valuation methods

Business valuations are based on the going-concern-principle and purely financial objectives. Therefore future projected earnings are discounted with risk-adjusted cost of capital. The sum of the present values of future earnings is the company value. This means that the value of the business is derived solely from its earnings power, i.e. its ability to earn cash flows for the owner or the shareholders. Any disposable non-essential assets have to be valued separately. Only if the present value of cash flows which would arise if the entire enterprise would be liquidated (liquidation value) exceeds the value of the business on a going-concern basis (including non-essential assets), the liquidation value represents the compensation value.

A detailed liquidation valuation is therefore only necessary in cases where it is assessable, after an approximate pre-calculation, that a liquidation value would exceed the value on a going concern basis including all non-essential assets. The general practice of corporate valuation applies the methods of the dividend discount model and of discounted cash flow model (DCF). The DCF approach includes the WACC-method, the Flow-to-Equity and the Adjusted Present Value (APV) approach. With the same assumptions all methods will lead to the same business value.

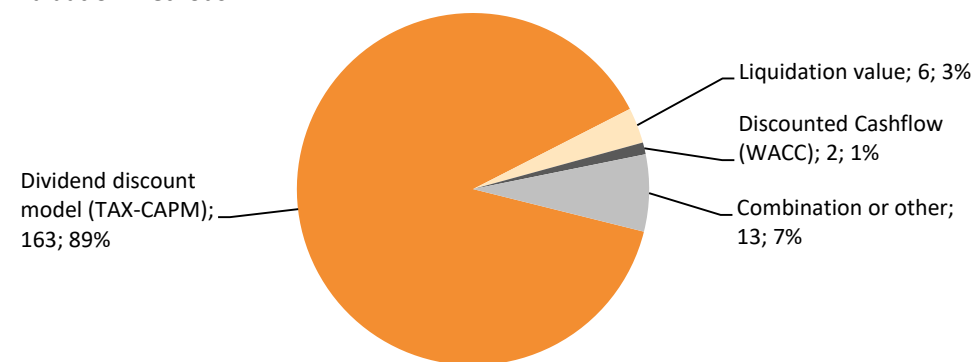
The dividend discount model and the Flow-to-Equity-method calculate the value of equity directly (equity value or equity approach) while the DCF-method calculates in a first step the entire enterprise value including the value of debt by discounting the cash flows before interest with the weighted average cost of capital (WACC). In the second step the value of net debt is subtracted from the enterprise value to derive the value of equity. Different to international contexts, valuations for legal measures according to German law in general require explicitly modelling of personal tax consequences on the level of a typified German shareholder for future dividends, capital gains and the effects of personal taxes on the discount rate (the so called TAX-CAPM).

2.1 Valuation methods

The dividend discount model based on the Tax-CAPM is still the basis of the majority of valuations and was applied in 89 % of the examined valuations in the years 2010 until 2018. In four cases the DCF-approach (WACC) was applied besides the dividend discount model. After a case in 2010 with the sole application of a DCF-model such a case was observable again in 2017. This case covered an Austrian subsidiary of a German company. The valuation was conducted according to German standards as well as to the so called KFS/BW 1 standard for corporate valuation of the Austrian Institute of Chartered Accountants.

In seven cases of analyzed valuation reports the derivation of a positive dividend discount value was not possible. The reports therefore included comprehensive liquidation valuations and in one case a net asset value calculation resulting from an asset-based approach to derive the compensation. In two cases different approaches have been applied to different parts of the enterprises. Four cases were based solely on the net asset value approach (NAV).

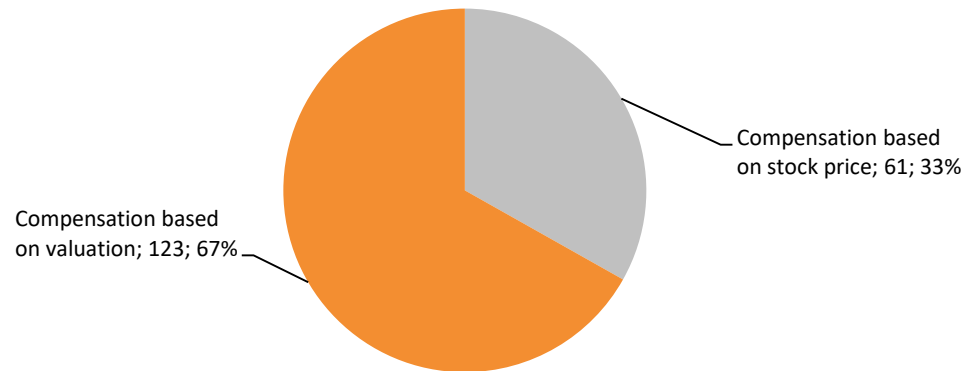
Valuation methods



2.2 Compensation based on valuation or stock price

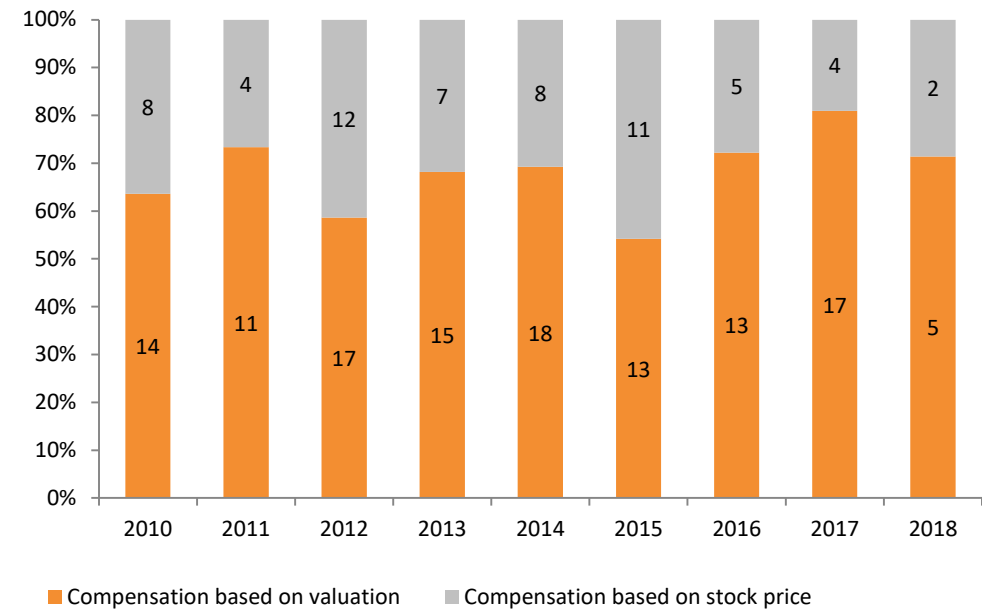
In 67 % of the cases in the years 2010 until 2018 the compensation was based on the derived enterprise value as the calculated enterprise value per stock was higher than the respective stock price or a stock price could not be derived due to previous delisting procedures.

Compensation based on valuation vs. stock price



5 of the total 7 cases in 2018 covered stock-listed companies. In two of these cases the stock price exceeded the derived value per stock.

Compensation based on valuation and based on stock price

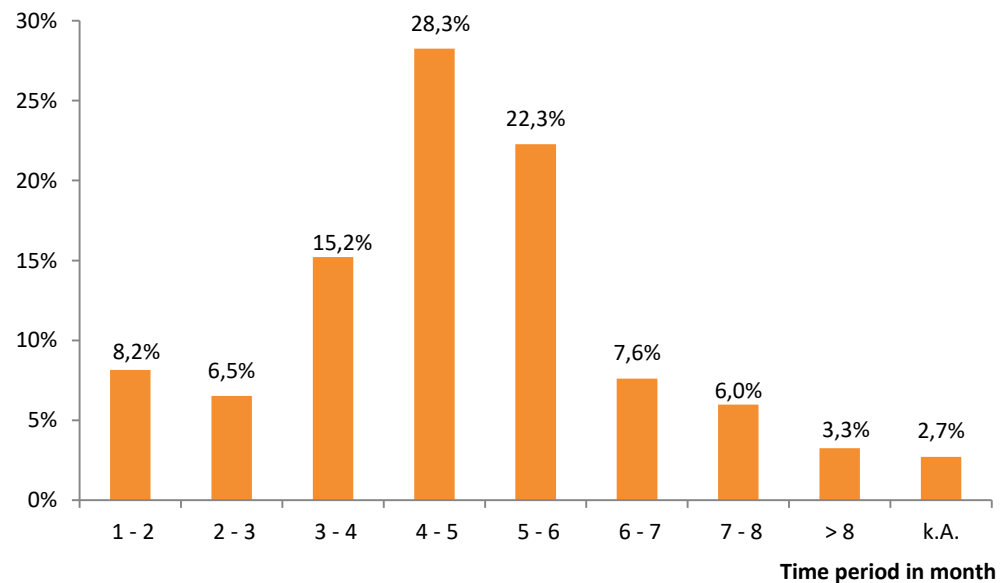


2.3 Period between ad-hoc and valuation date

The period between the ad-hoc announcement of the valuation and the valuation date itself is 4.8 months on average. The minimum period is 1.2 months and the maximum period is 22.4 months. In this incidence the stock price was extrapolated to derive the final compensation payment.

In the majority of the cases the ad-hoc announcement of the measurement, the squeeze-out or the conclusion of a corporate contract such as a control and profit transfer agreement, was made within four until six months before the valuation date. In 2018 the average time period between announcement and valuation date was 4.9 months. In four or 2.7 % of all cases the exact announcement date was not stated or could not be determined.

Period in months between announcement and valuation date 2010 - 2018



3 Distributable earnings and business plans

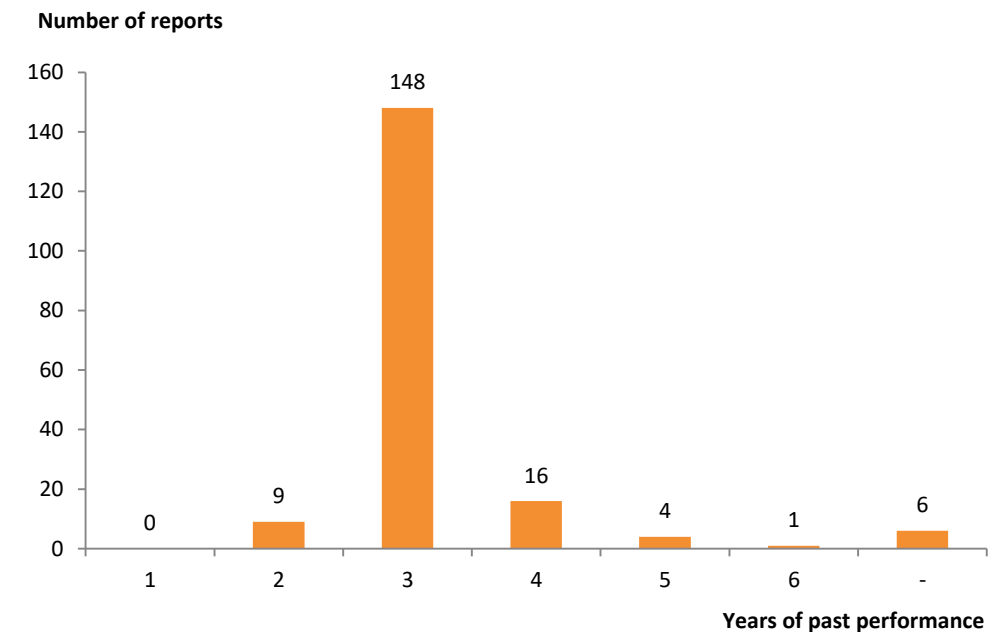
3.1 Analysis of past performance

Analysis of past performance

The purpose of the analysis of the past performance is the assessment of an appropriate benchmark for the business plan and management's projections of future earnings. To ensure comparability and in order to determine the reasons for past success, historic financial statements are adjusted accordingly by eliminating extraordinary results or results for other accounting periods, accounting changes or changes of the past corporate structure (e.g. M&A activities, buying and selling of subsidiaries, carve-outs of business units etc.). Past performance and historic financial statements should be presented and described in sufficient details. The relevance of past performances and historic financial statements reduces with further time lag to the valuation date.

80 % of the cases cover a three years period of past performance.

Years of analysis of past performance



3.2 Projection of future cash flows and business plan

Projections of future cash flows

A realistic, current planning calculation is the basis of the company valuation. According to IDW S1 as amended in 2008 paragraph 90 et seq., the planning on which the company valuation is based should reflect expected values and give equal weight to risks and opportunities, i.e. be neither optimistic nor pessimistic. The IDW Practical Note 2/2017 provides recommendations for the assessment of corporate planning in valuation, restructuring, due diligence and fairness opinions. But business plans usually applied in business valuations may have management steering functions or the purpose to incentivize the company management. In those cases the business plans do not present expected values but aggressive targets to align management's incentives. At the same time outdated, over pessimistic or optimistic forecasts or business plans with technical shortfalls have to be adjusted by the valuator to reflect expected values and realistic projections.

Projection of cash flows in phases

The accuracy of cash flow projection diminishes the longer into the future the business plan assumptions reach. Long term forecasts are therefore less reliable than the business plan projections in the years close to the valuation date. For that reason the projection of future cash flows of the business valuation is separated into a detailed planning phase (so called phase I of the business plan) and an assumption about a terminal value in perpetuity (so called phase II or terminal value).

There is no fixed rule regarding the length of the planning horizon. The planning horizon should be so long that the recognizable, initiated developments are completed and the company has reached a state of equilibrium, so that a sustainable result can be assumed for the period thereafter, which may grow at a constant growth rate.

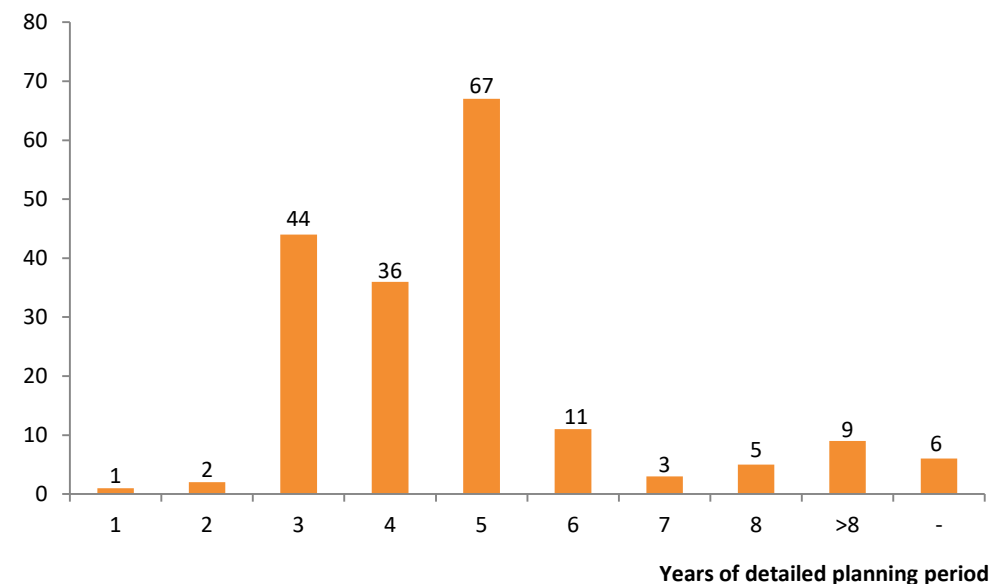
3.2.1 Planning horizon, extended forecast and sustainable earnings

As business plans are usually optimistically biased or assume positive future developments, shorter business plan time horizons result – assuming same growth assumptions – in lower business values compared to longer planning horizons. In this study we therefore analyzed the planning horizons applied by valutors.

The following chart for the years 2010 until 2018 illustrates that 80 % of the valutors applied a planning horizon of three to five years. In 43 % of the cases, a planning horizon of five years was expected. Only 2 % of the cases in 2010 until 2018 applied a shorter planning horizon. Significantly longer planning horizons are mainly chosen for infrastructure companies like solar parks or life insurances companies.

Years planning horizon

Number of reports



Extension of the detailed forecasts and derivation of the terminal value

In 2016 in 53 % of the valuations the terminal value was derived from the EBIT(DA) of the last forecast year plus the growth rate for one year. Yet, in three of the 15 cases the valuator have extended the detailed forecast by a second phase.

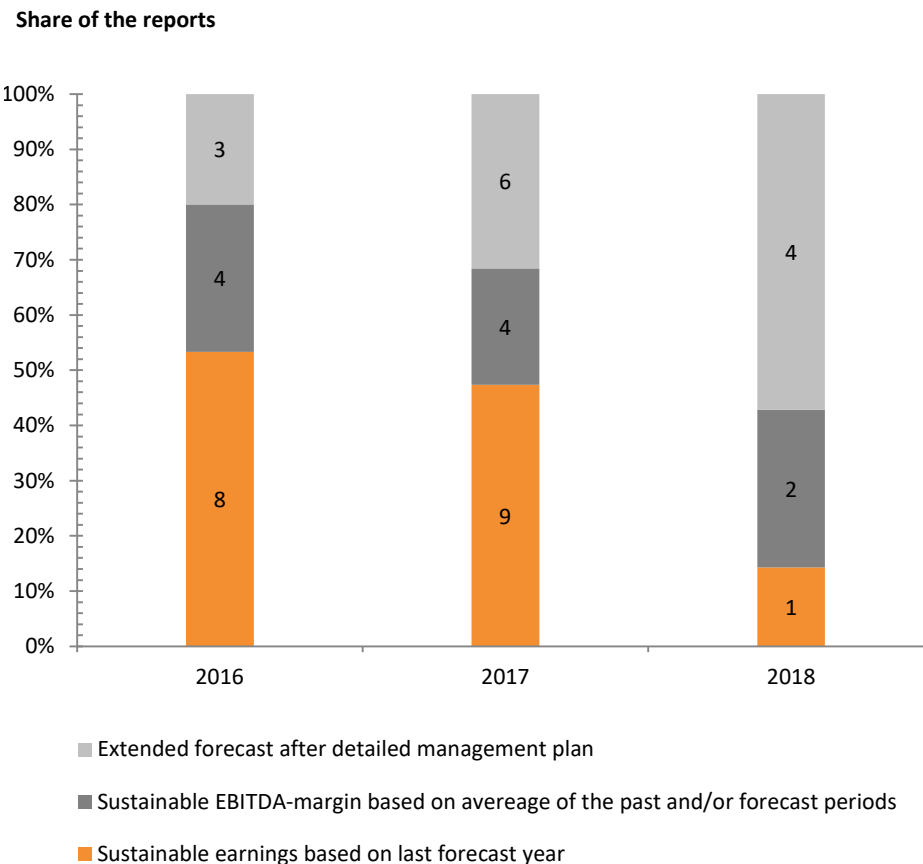
In 2018 in only one of seven valuations the sustainable earnings were derived from the EBIT(DA) of the last detailed forecast year. In two cases the valuator have extended the detailed forecasts for three years by further three or seven years respectively. These extended forecasts were presented in the reports and discounted directly.

One valuator extended a four-year plan by another 15 years. The report showed the development of the revenues, but not the full earnings forecast. The earnings for the 15 year period were annualized in an auxiliary calculation that was not presented in the report for deriving the sustainable earnings.

Another valuation report contained a five year forecast that was extended for an undisclosed time period in order to take account of synergies and competition authority obligations. The extended forecast results were not presented in the report, but flow into the sustainable earnings, which were higher than those of the last detailed forecast year.

We also observed that the sustainable earnings are derived from average EBIT or BITDA margins in the past and/or in the forecast periods.

The following chart shows the decreasing share of valuation reports, in which the sustainable earnings are derived from the last management forecast year, in the years 2016 to 2018:

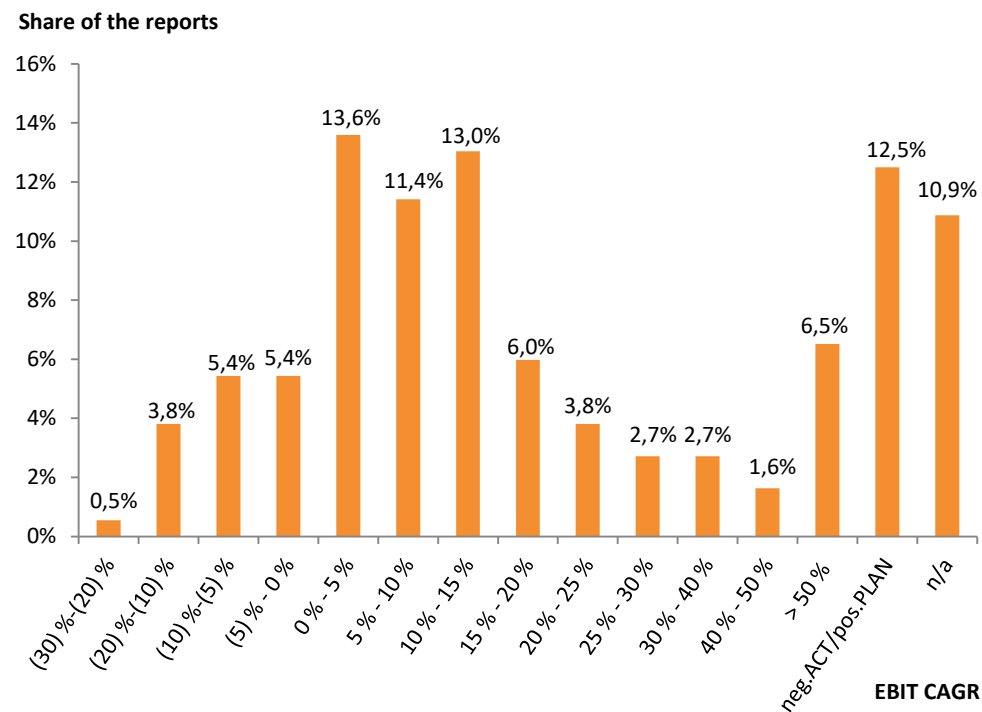


Valuations with sustainable earnings including re-investment rates instead of depreciations and the growth rate for one year were categorized as “sustainable earnings based on last forecast year”.

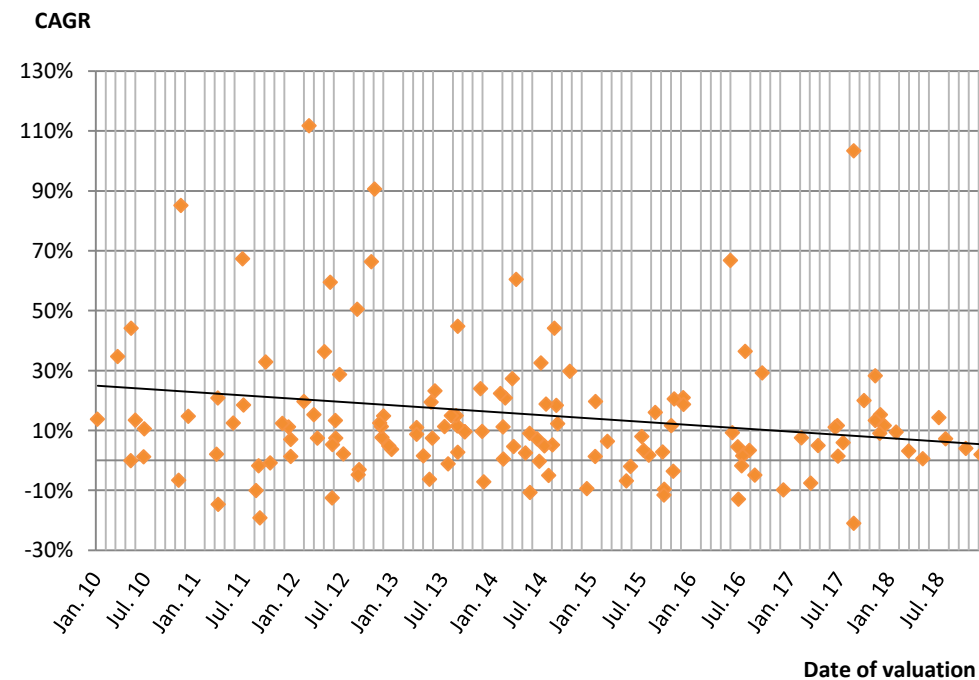
3.2.2 Assumption for earnings growth

A compounded annual growth rate (CAGR) was calculated by comparing the last adjusted actual EBIT with the EBIT figure of the last year of the planning horizon. The 141 analyzable business plans show in average an annual adjusted EBIT growth rate of 15.6 %. The median of the annual adjusted EBIT growth is 9.4 %. In 23 cases the CAGR could not be calculated due to negative EBIT-values in the last financial statements, despite positive forecasts for the planning horizon.

Average growth rate in business plans (CAGR) based on last reported EBIT



Average growth rate in business plans (CGAR) based on last reported EBIT since 2010



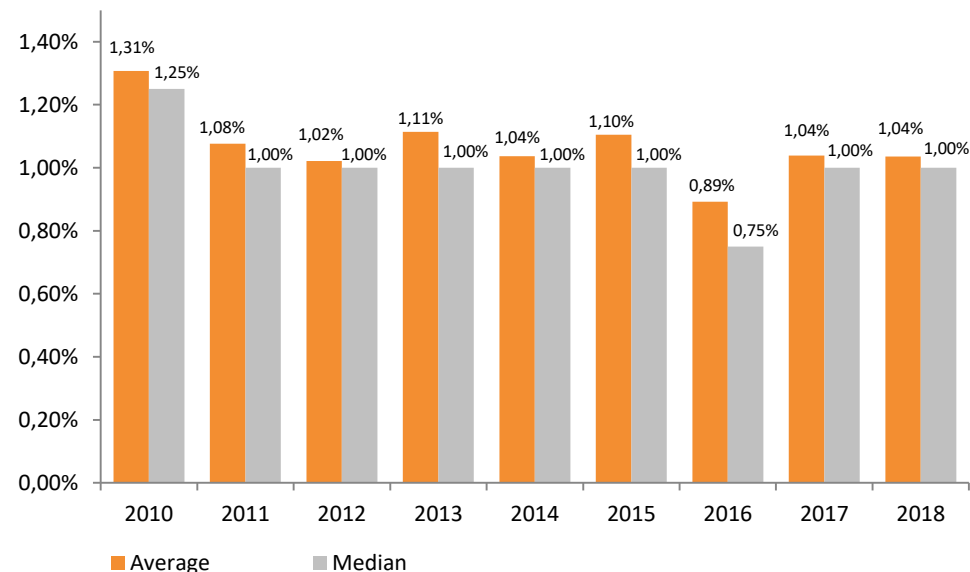
3.3 Growth rate in the terminal value

Terminal growth rate

In business valuations the terminal value (also continuing value or horizon value) of a company is the present value of all future cash flows when the continuation of a stable growth rate can be expected forever (phase II or terminal value). This perpetuity value is calculated by a discount rate including the assumed perpetual growth rate.

Besides the terminal growth rate as an assumption for perpetual growth, a growth-related retention amount can be applied. The underlying assumption is that for generating a perpetual growth, a specified proportion of the perpetual earnings has to be retained and invested into the company to sustain this perpetuity. Assuming that the company's return on invested capital equals the required cost of capital, such a growth-related retention has no effect on the company value beside its tax consequences. An increasing value only results if the retention amount (before taxes) assumes a lower tax burden on the shareholder level than the tax charge for dividends. This can be justified by assuming that capital contribution through dividends or realized capital gains by selling the company shares will occur later than the capital retention. The personal taxes on this effect are realized in the future and therefore their present value is lower compared to an immediate taxation of the earnings distribution.

Perpetual growth rates

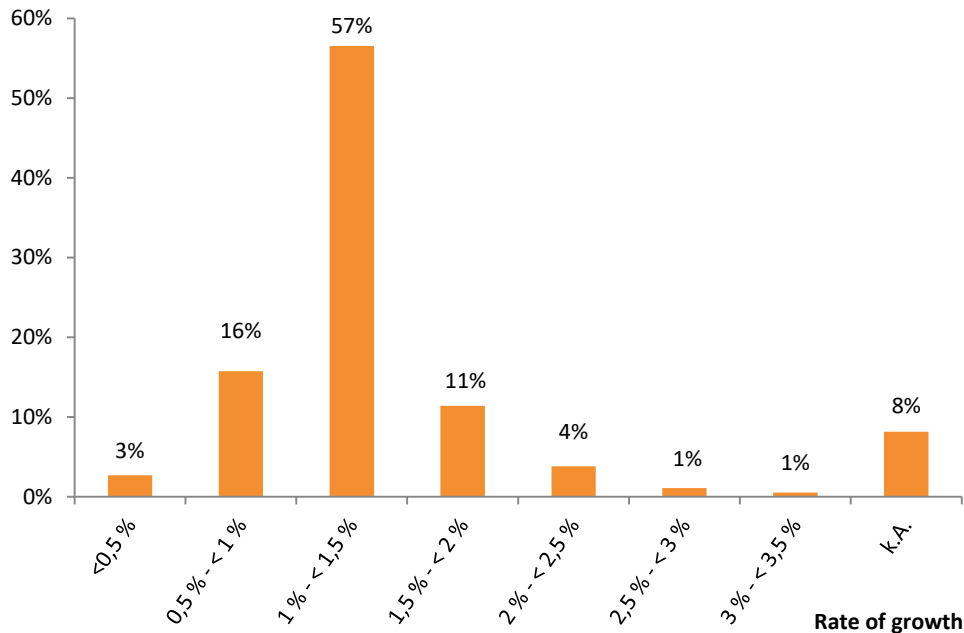


169 cases give details on the determination and magnitude of the perpetual growth rate. From 2010 until 2016 the median of the perpetual growth rate of the sustainable earnings reduced from 1.25 % to 0.75 %. This observation is accompanied with a reduction of the risk free rate from 4.25 % in the 1st Quarter 2010 to 0.57 % in the 4th Quarter 2016 (for the risk free rate see section 4.1). In 2017 and 2018, the median of growth rates rose again to 1.00 %, while the median of base rates also rose by 0.25 percentage points in 2017 and remained constant at 1.25 % in 2018.

The variation of the growth assumption over all cases is low, illustrated by the following chart:

Perpetual growth rates

Share of the reports



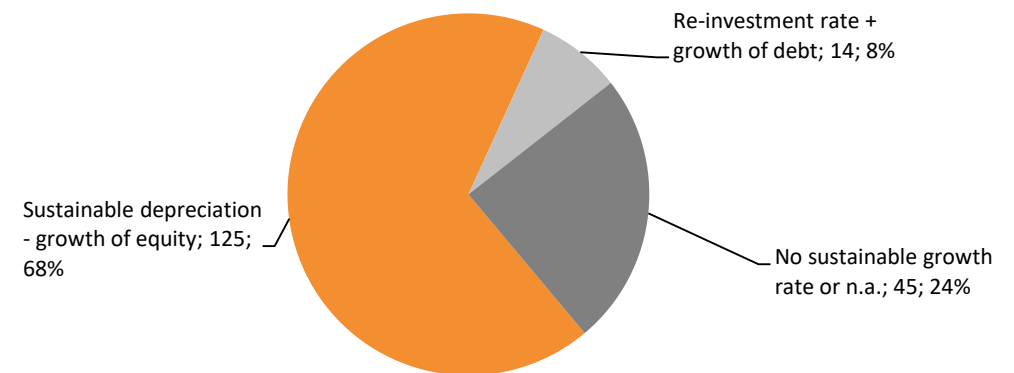
In 94 cases (56 % of all capitalized earnings valuations) a perpetual growth rate of exactly 1.00 % was applied.

In 2018 only one case applied a perpetual growth rate of the terminal value earnings level of higher than 1.00 %. This is the sustainable growth rate for a bank that accounted for 1.5 %. The majority of the cases assume adjustments of the capital structure of debt and equity to finance perpetual growth. 24 % of the cases did not apply a perpetual growth rate or were not analyzable due to missing information.

There are two approaches concerning perpetual growth related capital adjustments. In general they may lead to comparable results. 68 % of the cases assumed a perpetual growth of depreciations and necessary equity growth for perpetual earnings growth.

Meanwhile 8 % of the cases assumed a higher reinvestment rate for CAPEX to account for necessary growth of the sustainable asset base. The necessary investment rate is financed by debt and equity. In those cases earnings are increased by the debt-financed and interest-carrying proportion of net-investment based on the planned debt ratio in the capital structure. The reports state this mainly as “changes in net debt to sustain perpetual debt ratio”. Two of these reports also show a contrary effect of the perpetual growth retention necessary for the working capital of the valuation target.

Perpetual depreciation or reinvestment rate



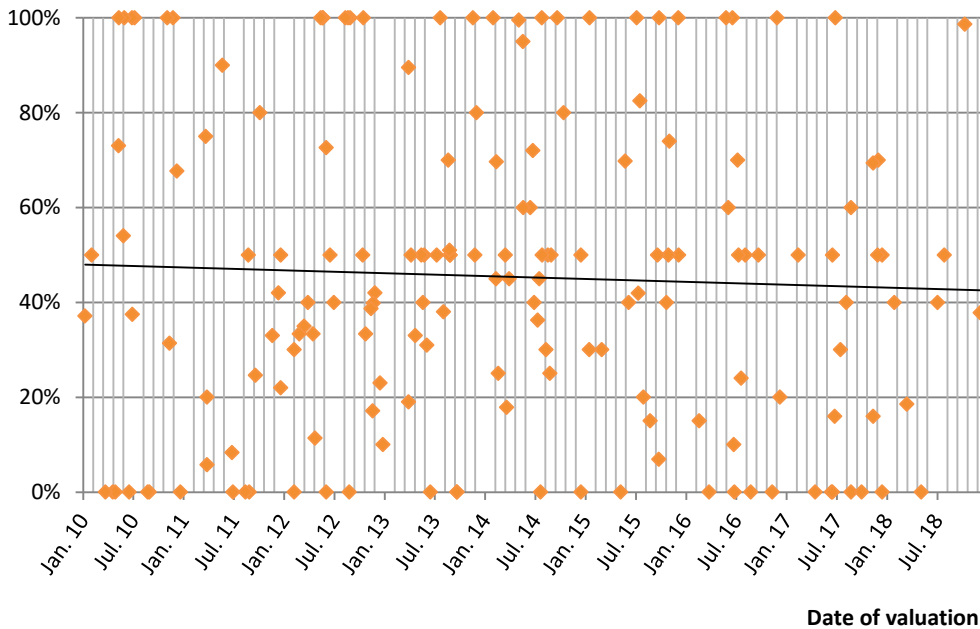
3.4 Payout ratios

The relevance of payout ratios

The applied payout ratios have an effect on the company value. In general it is assumed that retained earnings are taxed in the far future, while distributions (e.g. dividends) are taxed immediately with withholding taxes in Germany. Therefore retained earnings are assumed to be taxed with the half tax rate on capital gain tax rate to account for this present value tax effect. Through this tax deferral the retaining of earnings lead to higher company values than immediate distribution.

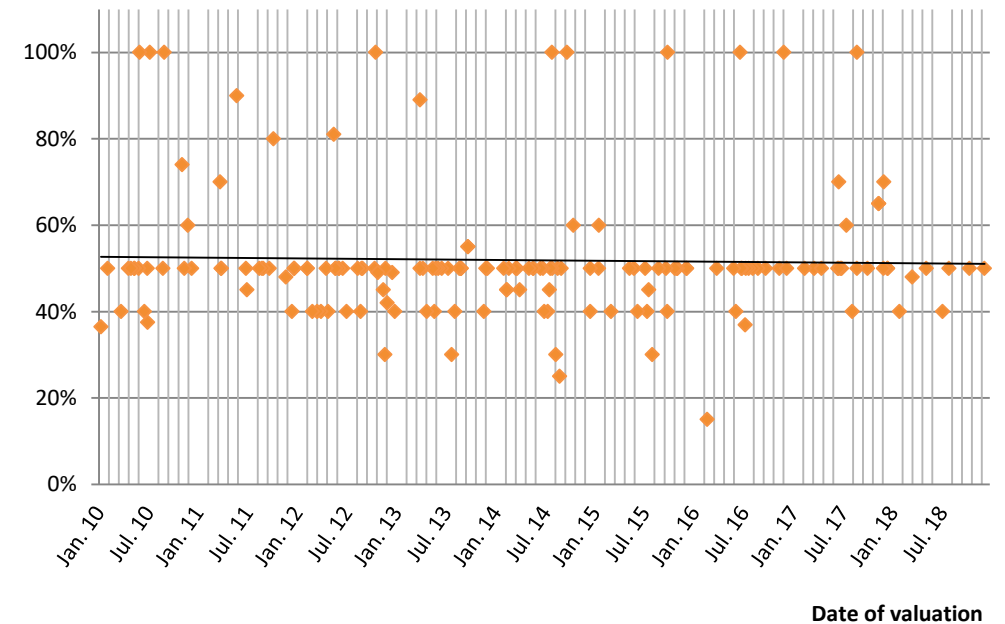
The planned capital distribution ratios in the business plan periods are based on the company planning and vary strongly. The average payout ratio in the study was 46 % and the median is 44 %. There is no clear trend determinable over all cases as the following chart illustrates:

Payout ratios in the business plans



The variance of perpetual payout ratios is significantly lower with an average value of 52 % and a median of 50 %. The perpetual payout ratios are derived in different ways, e.g. based on the payout ratios of the industry sector, the specific peer group to the valuation target or the valuation target itself.

Payout ratio in perpetuity



4 Discount rate and cost of capital

Derivation of the discount rate and the cost of capital

The discount rate can be expressed as the investment alternative of the investor. The discount rate therefore represents the interest rate or return an investor would expect or should demand when investing in a comparable risky asset. The discount rate should therefore be equivalent to the valuation target concerning its maturity, its risk and its taxation.

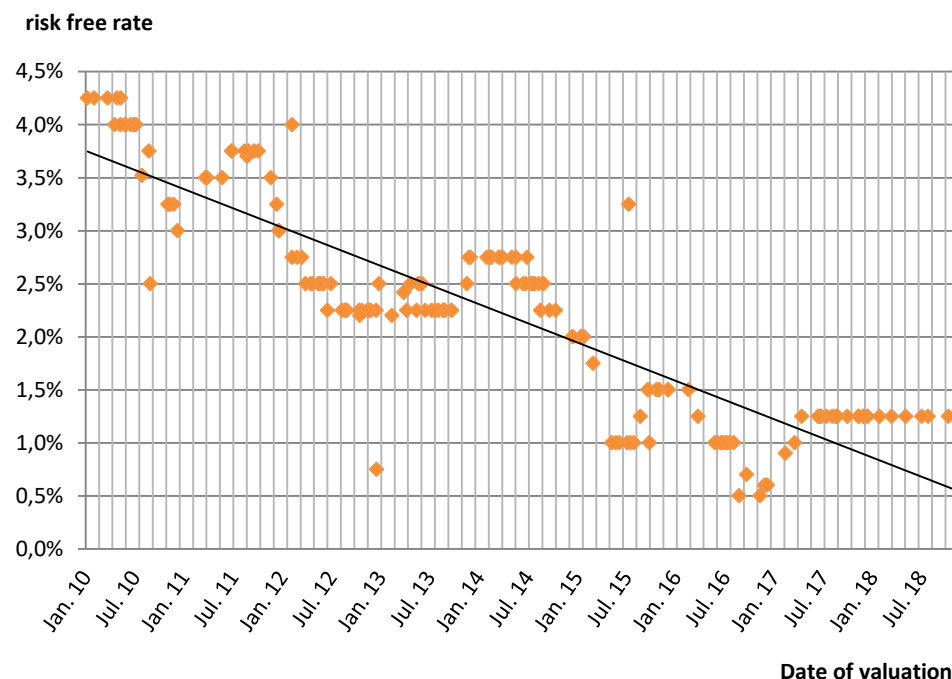
4.1 The risk free rate

Role of the risk free rate within the CAPM

In the theory of the Capital Asset Pricing Model (CAPM) the risk free rate represents an entire risk-free interest rate to invest in anytime and without friction. As risk free rates are not observable in practice the risk free rate is determined by investments in government bonds of the Federal Republic of Germany as the closest proxy. Therefore the equivalence of maturities between public bonds and the valuation target has to be considered.

The average risk free rate has decreased with the interest level in the capital markets from 4.25 % in the 1st Quarter of 2010 until 1.25 % in 4th Quarter in 2018. The lowest value of the risk free rate was reached in 2016. The variance of applied risk free rates in the study is low. For the 30th August 2010 an unusually low risk free rate (2.5 %) was applied as the valuation target did only plan one capital distribution in the year 2017. In December 2012 a case assumed for a maturity of 6 years an equivalent risk free rate of 0.75 %. The outlier in the year 2015 refers to a valuation target with operations in China where the risk free rate was determined partially with Chinese interest rates and partially with German risk free rates. In 2018 all valuations in the study applied a risk free rate of 1.25 %.

The development of the applied risk free rate in the examined time of the study and its variances are illustrated in the following chart:



The development of the average risk free rate and the median in each year can be summarized for the years 2010 until 2017 in the following table:

Period	2010	2011	2012	2013	2014	2015	2016	2017	2018
1st Quarter	4,25%	3,50%	2,95%	2,35%	2,75%	2,10%	1,38%	0,95%	1,25%
2nd Quarter	4,06%	3,63%	2,47%	2,39%	2,63%	1,00%	1,00%	1,25%	1,25%
3rd Quarter	3,44%	3,74%	2,29%	2,25%	2,48%	1,44%	0,87%	1,25%	1,25%
4th Quarter	3,19%	3,30%	2,12%	2,67%	2,08%	1,50%	0,57%	1,25%	1,25%
Annual Average	3,79%	3,53%	2,39%	2,37%	2,52%	1,55%	0,92%	1,22%	1,25%
Annual Median	4,00%	3,50%	2,25%	2,25%	2,50%	1,50%	1,00%	1,25%	1,25%

4.2 The market risk premium

The market risk premium within the CAPM

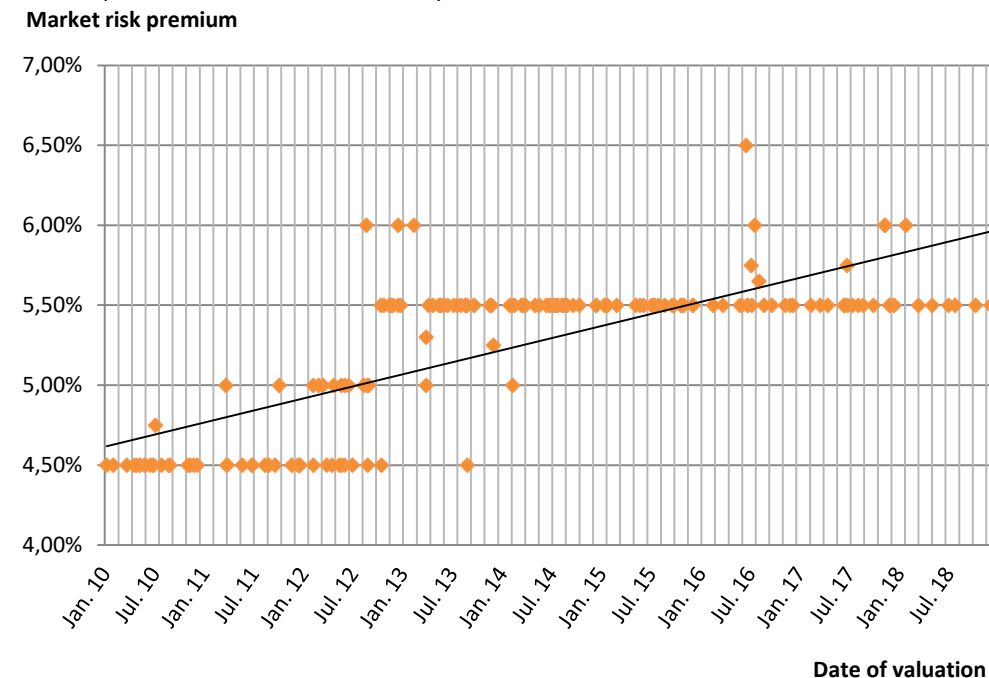
Within the CAPM the market risk premium is one of the two parameters determining the cost of capital as the defined 'systematic risk component'. In theory the market risk premium is the demanded average excess return figure all equity investors expect or demand on average. The market risk premium is therefore derived by comparing the return of a diversified market portfolio as the proxy for the market and the risk free rate. The market portfolio consists of all risky investment opportunities in the entire market. As German legal valuations require the consideration of personal income taxes on the level of the shareholder (TAX-CAPM) the market risk premium in the valuations reflect a return measure after personal income taxes.

The market risk premium in practice

For estimating the market risk premium in practice historic return differentials between a market portfolio and the risk free rate are derived by applying a broad market index as a proxy for the expected market return. The risk free rate is usually determined through historic yields of German government bonds. The historic market risk premium is then the result of the differential between the average historic market return and the average risk free rate. It is not a demanded, but a historically realized return figure.

In comparison to the historic market risk premium an implicit forward looking market risk premium can be derived by applying dividend discount models or Discounted-Cash-Flow-Models (DCF) based on current stock valuations, analysts' forecast, the risk free rate and the beta-factor of a stock. The implicit market risk premium equals the equation of the market cap of a company to its calculated theoretical model value. If this operation is done for a large sample of stocks representing an entire market portfolio and for a longer time period of historic dates, the implicitly demanded market risk premium of the capital market can be calculated.

The following chart illustrates the development of the applied after-personal-taxes market risk premiums over the entire study since 2010:



Average market risk premiums after personal taxes

Period	2010	2011	2012	2013	2014	2015	2016	2017	2018
1st Quarter	4,50%	4,67%	4,80%	5,43%	5,40%	5,50%	5,50%	5,50%	5,75%
2nd Quarter	4,50%	4,50%	4,75%	5,50%	5,50%	5,50%	5,70%	5,55%	5,50%
3rd Quarter	4,56%	4,50%	5,00%	5,39%	5,50%	5,50%	5,65%	5,50%	5,50%
4th Quarter	4,50%	4,60%	5,45%	5,42%	5,50%	5,50%	5,50%	5,64%	5,50%
Annual Average	4,51%	4,57%	5,05%	5,43%	5,48%	5,50%	5,62%	5,57%	5,57%
Annual Median	4,50%	4,50%	5,00%	5,50%	5,50%	5,50%	5,50%	5,50%	5,50%

An increase of the applied market risk premiums can be observed since the year 2012, especially in the 4th Quarter of 2012. This observation is connected to the recommendation by the standard setter IDW (the technical Committee for Business Valuation and Economics within the German Institute of Public Auditors in Germany). Since February 2012 the standard setter is suggesting to set the market risk premium in valuations at the upper end of the recommend range of 4.0 % - 5.0 % after personal taxes to account for volatility in the capital markets. From September 2012 on, the IDW recommend a higher band of the market risk premium after personal income taxes from 5.0 % to 6.0 %. The average of this band is a market risk premium of 5.5 %.

86 % of the valuations within the years 2013 until 2018 applied a market risk premium after personal taxes of 5.5 %. In eight cases since June 2016 a higher market risk premium was applied. The highest value was 6.5 %. In 2017 a case applied a market risk premium of 5.75 % while the comparing valuation of two merger entities was based on a market risk premium of 6.0 %. In 2018, in one case the market risk premium was scheduled in two variants at 5,5 % and 6.0 %. All other cases in 2017 and 2018 applied a market risk premium of 5.5 %.

As the estimates for the market risk premiums increased, the sum of market risk premium including the risk free rate (before personal income taxes) decreased from 8.8 % in the first quarter of 2010 to 6.8 % in the last quarter of 2018.

4.3 Beta factor

Beta factor within the CAPM

The beta factor is, beside the market risk premium, the second parameter for determining the cost of capital based on the CAPM to account for the systematic risk. The magnitude of the beta factor reflects the degree of systematic risk of a stock compared to the entire market. The systematic risk represents the proportion of the entire portfolio risk, which cannot be reduced through a diversified portfolio approach. The investor therefore only gets compensated for this non-diversifiable proportion of entire risk according to the CAPM, called systematic risk.

Interpretation of the beta factor

Multiplying the market risk premium with the beta factor leads to the risk premium of the investment. A higher beta factor therefore reflects a higher demanded return by the capital market participants for riskier investments compared to market average.

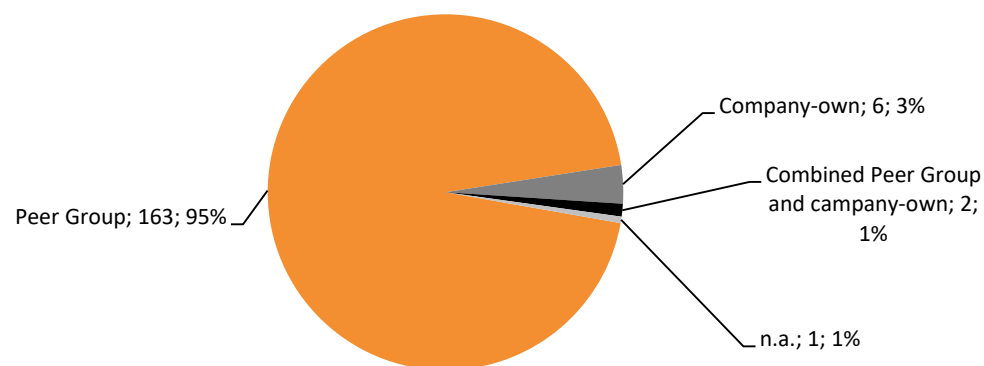
Mathematical definition of the beta factor

The beta factor of a stock-listed company is the statistically derived covariance between the stock's return and the return of the market index, divided by the variance of the market's return. Beta factors can be calculated through linear regressions of the stock's returns to the market's returns. The beta factor can then be expressed as the slope gradient of this statistical regression.

4.3.1 Peer Group or beta factor of the valuation target

95 % of the cases applying a dividend discount model or DCF-model derived the beta factor as an average or median of the beta factors of a peer group of comparable companies. Only 3 % of the valuations were based on the beta factor of the stock-listed valuation target itself. 1 % applied a composition of a peer-group approach and the own beta factor of the valuation target. In the two cases qualified as compositions of peer group and own beta factor, the valuator did not calculate the average of both figures but applied his assessment to determine the beta factor based on both analytical approaches. The own beta factor equaled nearly the average beta factor of the peer group in this cases.

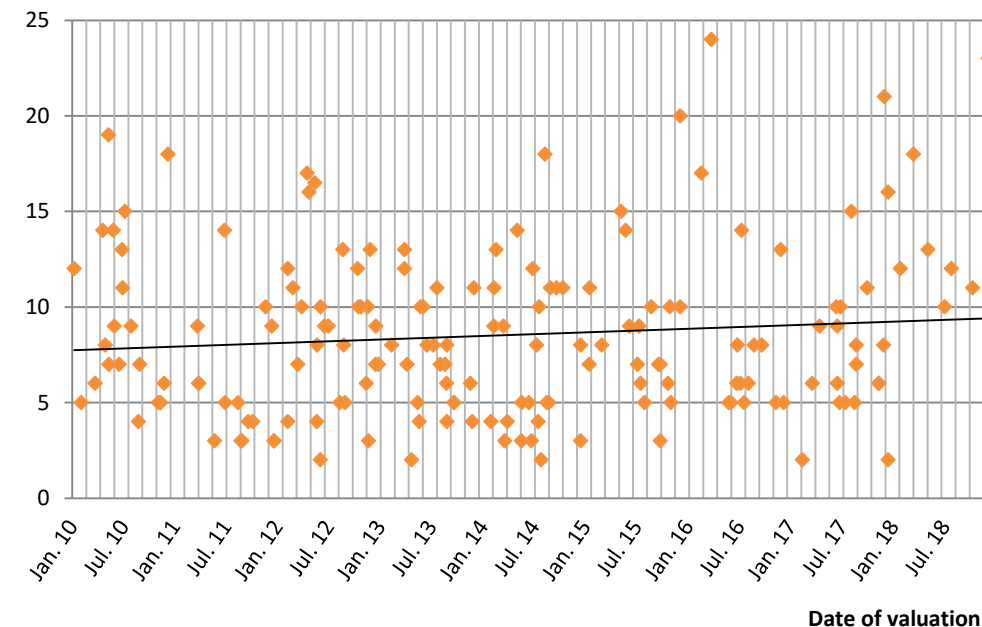
Peer Group or own beta factor



4.3.2 Number of peers

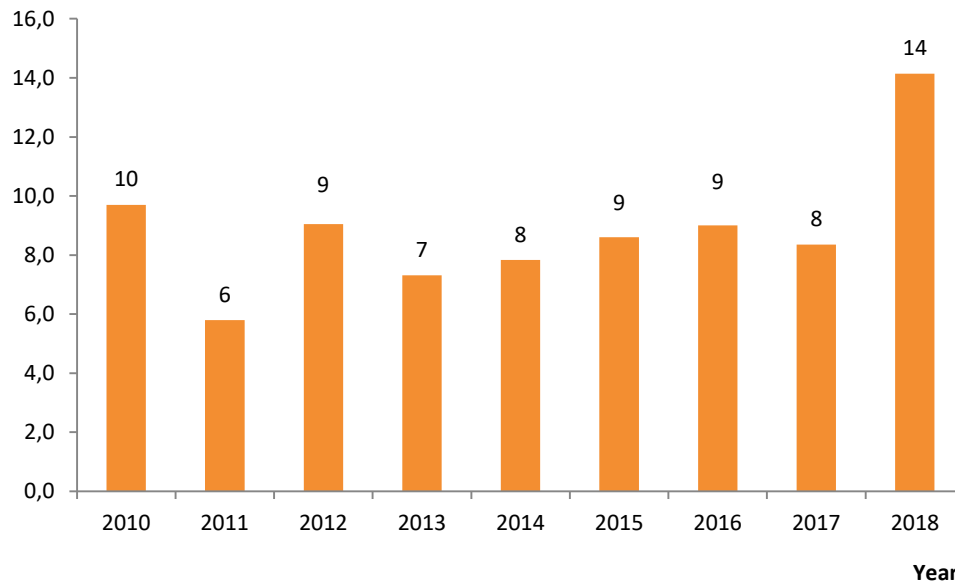
On average the beta factor is derived of 8.5 peer group companies, with a range from two companies to up to 24 companies in the peer group shown in the following chart:

Number of peer group-companies



The following chart illustrates the average number of companies in the peer group in each year of the study:

Average number of companies in the Peer Group



In 2018, an increase to an average of 14 companies in the peer group was observed.

4.3.3 Reference index

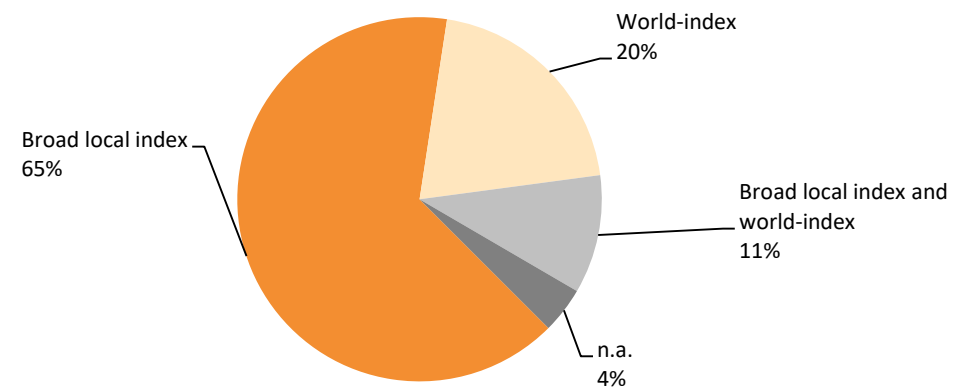
Reference index

The reference index represents the market portfolio of the investor and is part of the calculation of the covariance between the stock's return to the market's return, which flows into the calculation of the beta factor.

A global index represents the market portfolio for a well-diversified international investor which reflects the assumptions of CAPM more than a local index. Opponents to the application of global indices claim that global indices influence the statistical regression with different currency effects, meanwhile proponents of the approach argue that different currencies and their changes are a part of the total return variances that globally diversified portfolio investors have to face. A problem of a global approach can be the timing-difference between the index calculation and the stock quotes of the peer company (e.g. between the US and Asia), which may lead to underestimating the correlation of stock and market returns.

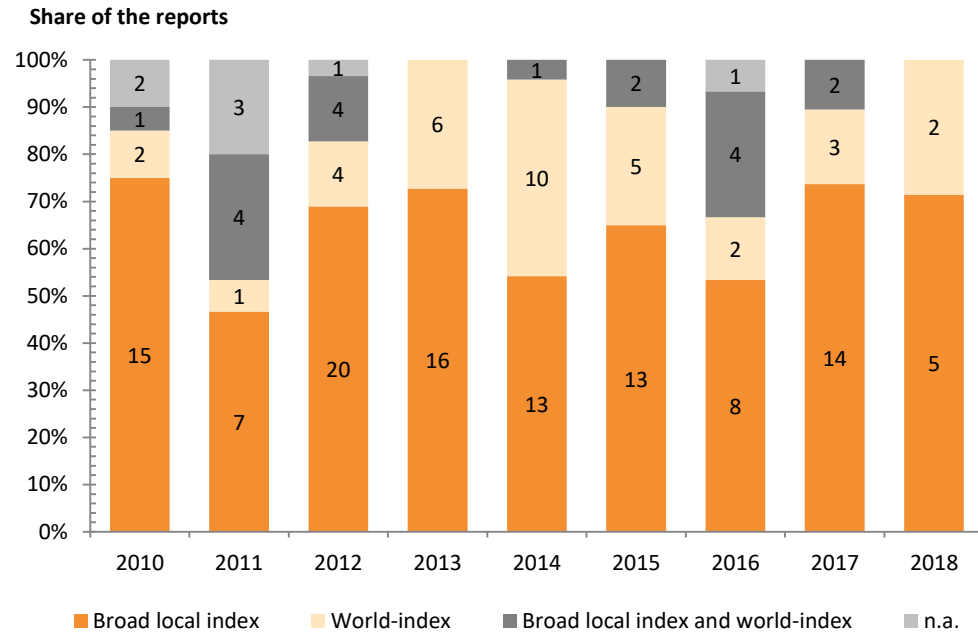
65 % of the cases applied a broad local index. For 20 % of the cases a global index (e.g. S&P 500 or MSCI World Index) was used.

Local or global Index



The proportion of valuations applying global indices for deriving the peer group beta has significantly increased in the years 2013 and 2014. In 2013 only 27 % of the valuations used a global index. In 2014 the number increased to a proportion of 43 %. But in 2015 until 2017 the amount decreased again and reached 16 % in 2017. In 2018 29 % of the cases applied a global index. The proportion of beta factor calculations which were based solely on a local index reached 71 % in 2018.

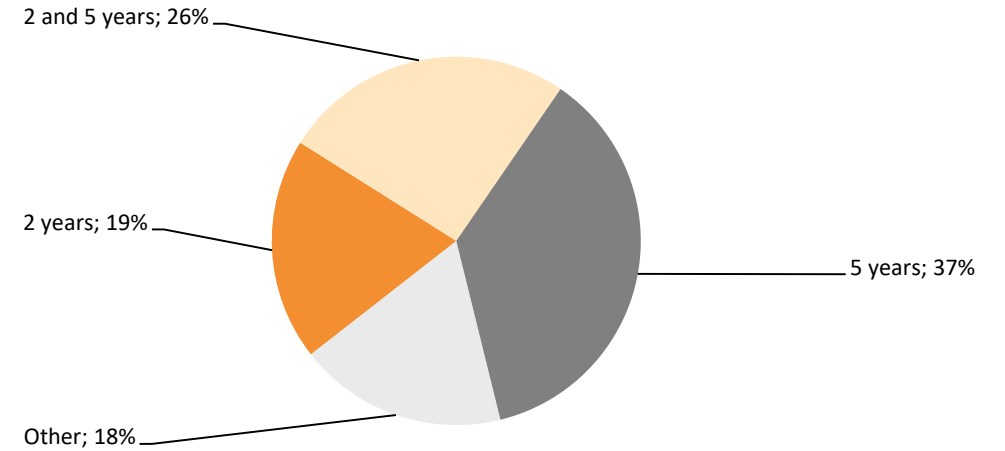
Local or global index in the years



4.3.4 Reference period

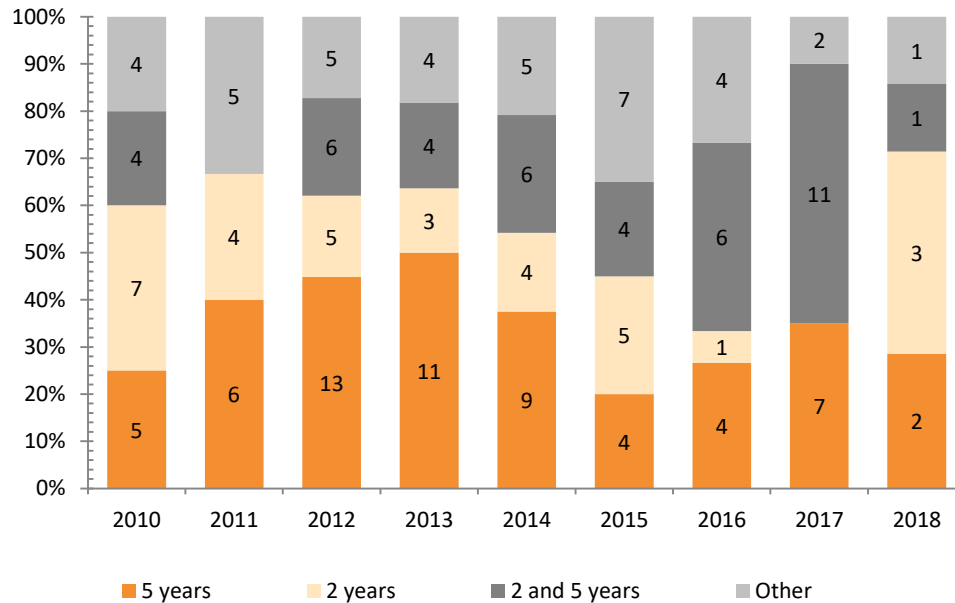
In 37 % of cases beta factors are calculated exclusively for five-year periods, in 26 % for two and five-year periods and in 19 % of the cases exclusively for two-year periods.

Period to assess the beta factor



Period to assess the beta factor

Share of the reports



The proportion of beta factor calculations, which were based both on 2-year and 5-year reference periods increased significantly to 40 % in 2016 and to 55 % in 2017. In 2018, however, this figure fell back to 16 %, which is put into perspective by a very low total number of cases this year.

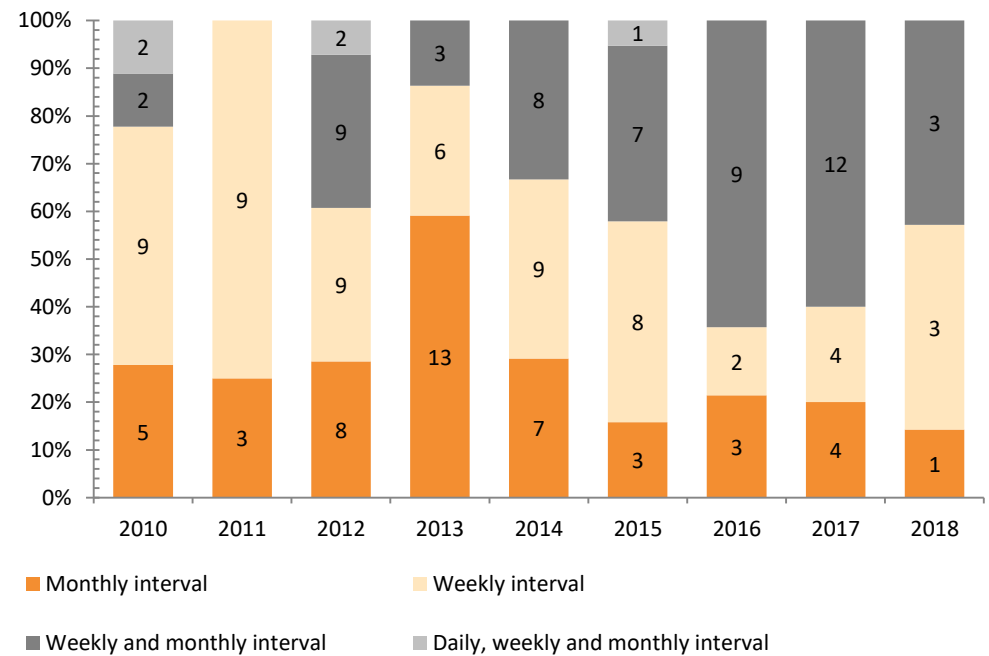
4.3.5 Interval

Different measured return intervals (monthly returns, weekly returns or daily returns) have impact on the statistical calculation of the beta factor. The analyzed cases apply in majority weekly and monthly intervals to derive beta factors. Daily return intervals in calculating the beta factor were applied in only 3 % of the cases. In 32 % of the cases different intervals have been applied.

Concerning the combination of periods and intervals a focus on 2 year periods with weekly return intervals and 5 year periods with monthly return intervals was observable. At the same time an increase of applying both weekly and monthly return intervals in parallel calculations has significantly increased since 2014 and was applied in 43 % of the cases in 2018.

Interval of beta factor calculations

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4.3.6 Raw or adjusted beta factor

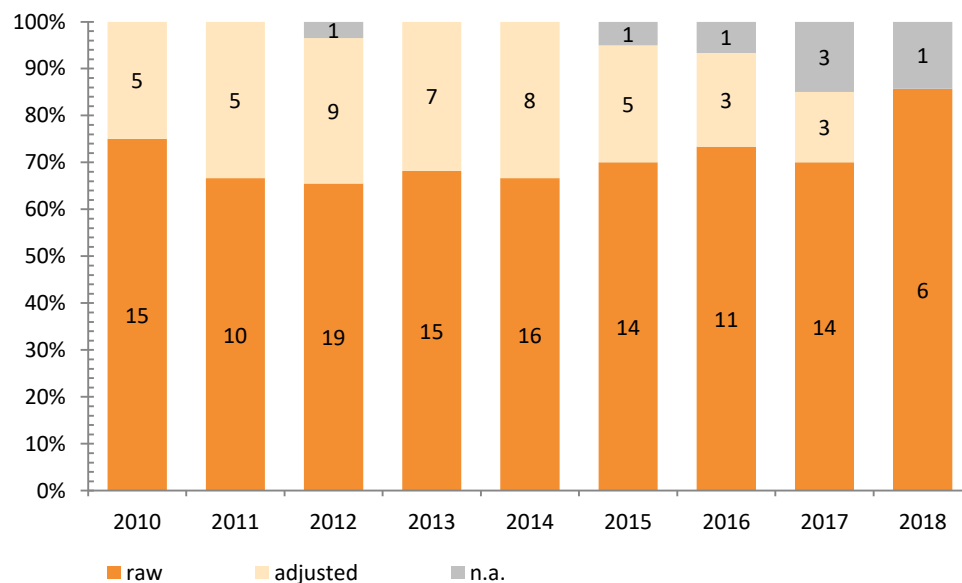
Reasoning of adjusting beta factors

Raw beta factors reflect the data derived by the statistics observed through the capital market data. Adjusted beta factors are based on the assumption that beta factors have a statistical auto-regressive tendency to adjust in the long-term to the market beta factor with a value by definition of 1.0. Financial data provider Bloomberg provides adjusted beta factors which are the sum of weighting 0.66 * the raw beta factor and 0.33 (so called the “Blume” adjustment).

70 % of the valuation cases applied a raw beta factor without any further adjustments. In 2018 86 % of the cases applied this approach. On the other hand, the proportion of adjusted beta factors has fallen significantly since 2014.

Raw vs. adjusted beta factors

Share of the reports



4.3.7 Debt beta

Debt beta – theoretical meaning and derivation

In the process of un-levering the beta-factors of the peer group companies and re-levering the beta factor to the capital structure to the valuation target, a debt beta factor can be applied to account for the effect that creditors of the valuation target carry a portion of the entire risk associated to the valuation, thereby reducing the risk carried by the equity providers. For the determination of the debt beta the part of the interest rate spread representing the systematic risk proportion is compared to the market risk premium. Therefore the debt beta can be explained as the part of the systematic risk carried by the creditors. The credit margin or expected credit loss are not taken into consideration. Debt beta factors of stock-listed bonds of different rating classes can also be determined by statistical regression analysis.

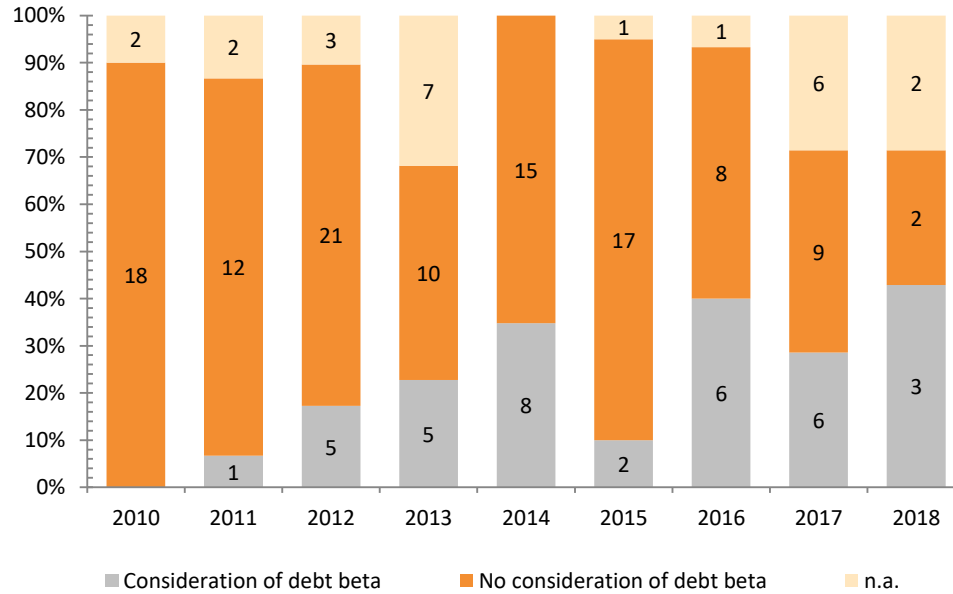
Consequences of applying debt beta

The application of debt beta over the entire credit spread leads to the same value for the dividend discount model as the DCF-method. Applying the debt beta should be consistent and applied both in un-levering the peer group beta factors and in re-levering the cost of capital to the valuation target. If the capital structure of the valuation target and the peer group do not differ significantly, the impact of the debt beta on the valuation is minor.

Since 2010 the application of debt beta has increased substantially.

Debt Beta

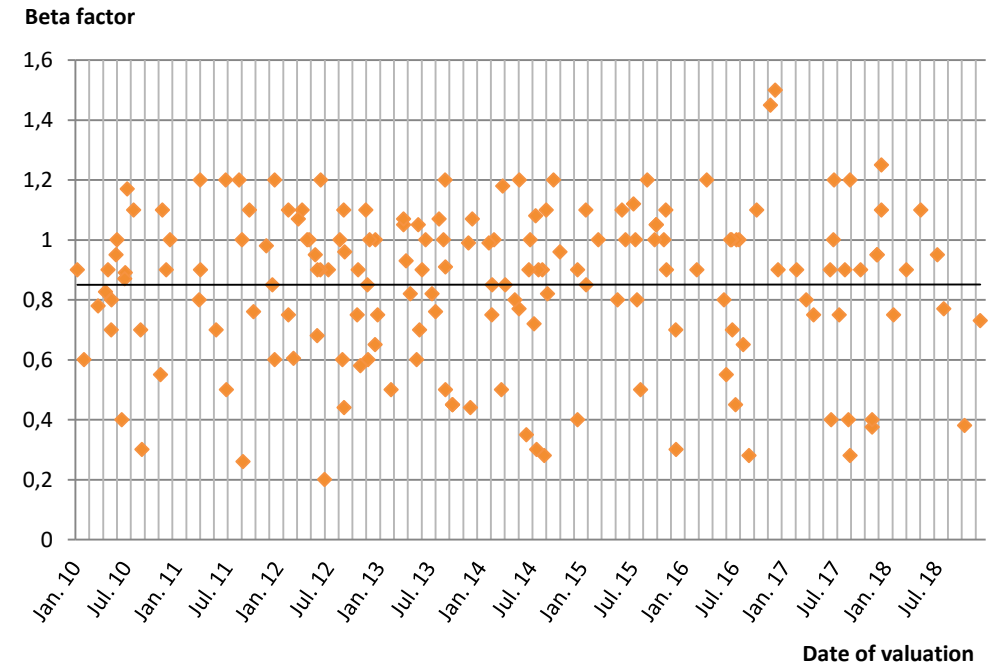
Share of the reports



4.3.8 Magnitude of unlevered beta factors

On average the valuations were based on an unlevered beta factor of 0.85. In general the beta factors of the valuation targets have a high variance due to all the different industries of the valuation targets in the study. An industry specific analysis of applied beta factors seems not suitable due to the small number of observances in each industry and the not always clear classification of the target companies into the different industries sectors.

Magnitude of unlevered beta factors



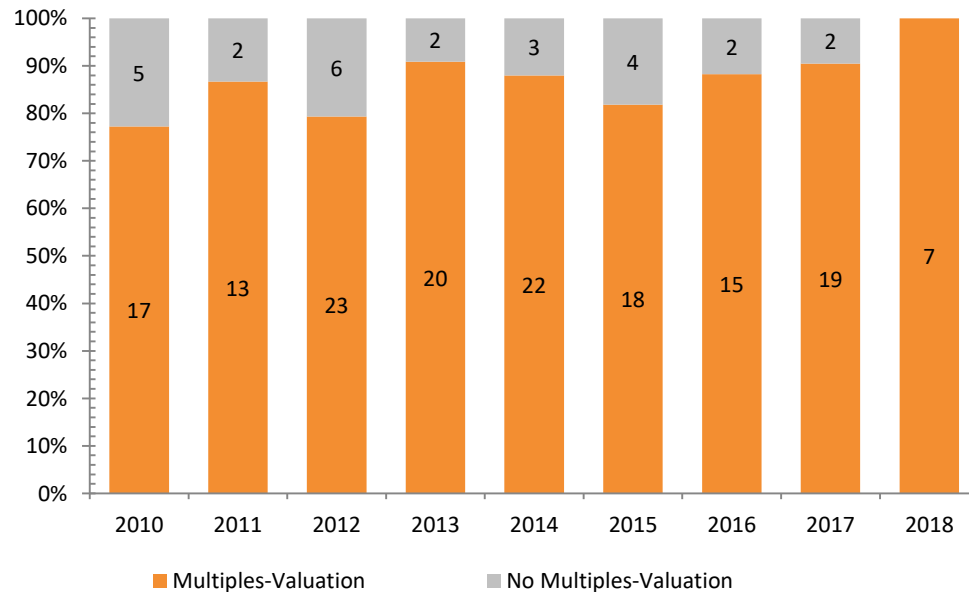
5 Market-based valuation and multiples

Market based valuation with multiples

A valuation based on multiples is a market based valuation approach. The valuation target is valued with price relations realized in market. Immanent to this approach is the assumption that comparable companies should trade at comparable values relatively. According to the German IDW standard market based valuations can only be applied for plausibility cross-checks of the comprehensive valuation according to the dividend discount model or DCF.

86 % of the valuers applied a multiple valuation approach for plausibility checks in their reports. In 2018 all cases included such a market-based approach with multiples.

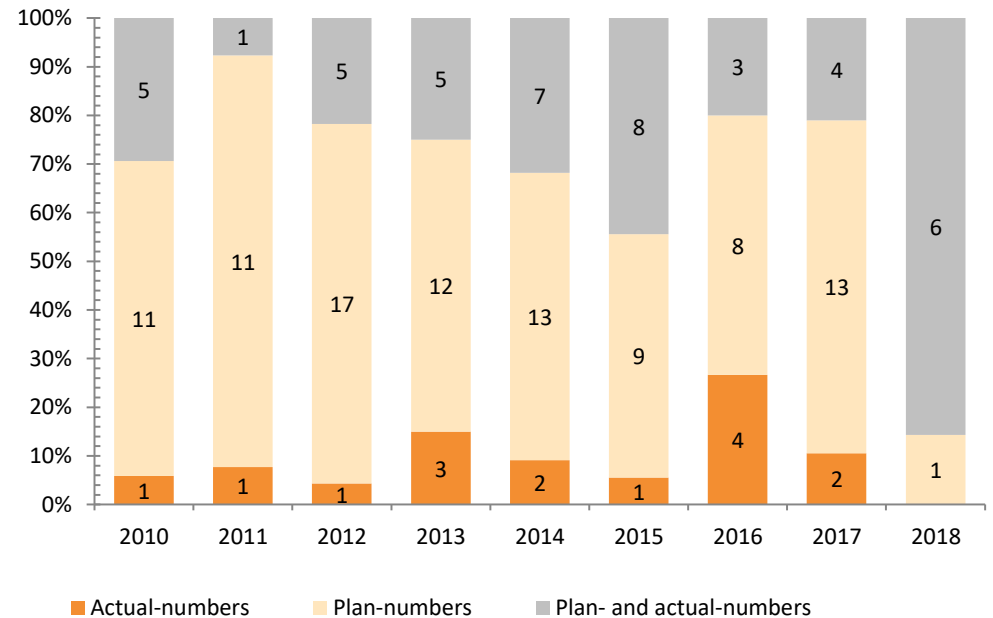
Multiple valuations



10 % of the cases of the years 2010 until 2018 used multiples solely derived of actual figures to validate the valuation result of the dividend discount model or the DCF-model. In 2018 the share of market valuations based on plan- and actual-multiples rocketed to a share of 85 %.

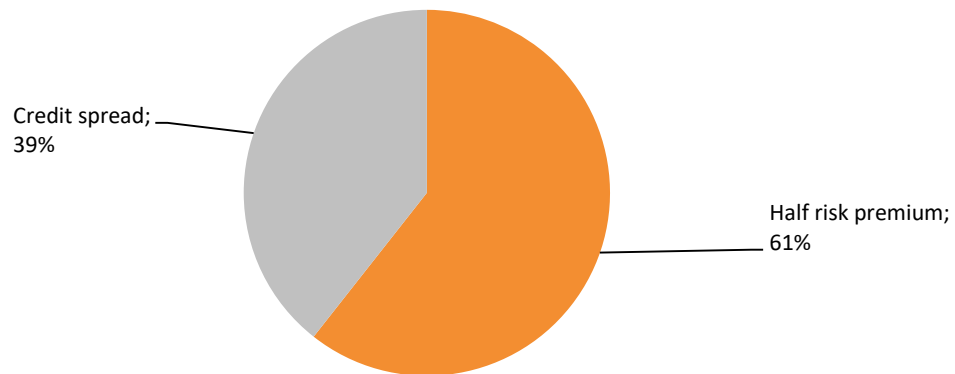
Multiples based on actual and forecast figures

Share of the reports



6 Control and profit transfer agreements

Control and profit transfer agreements offer the minority shareholder the choice between an immediate compensation and the possibility to continue its shareholder position under the corporate contract in return for a granted guaranteed annual dividend payment for the lasting time of the contract.



In general the guaranteed annual dividend payment is derived by annuitizing the company value. In 61 % of the cases the guaranteed annual dividend payment was calculated with a risk free rate plus half of the calculated risk premium of the valuation. In 39 % of the cases this annuity was calculated with the risk free rate and a credit-spread yield to account for the credit risk of the majority shareholder.

About I-ADVISE

We are an independent audit and advisory firm specialised in transaction advisory and valuation services. Key characteristics of our consulting approach are a distinctive team structure with senior transaction and valuation specialists guaranteeing independence and exclusivity as an advisor to our clients. I-ADVISE AG has offices in Düsseldorf and Frankfurt and is part of an international network of advisory firms which complement our teams in cross-border projects.

The valuation services team acts as advisor, independent expert or arbitrator in valuation projects triggered by e.g. the acquisition and sale of a company or business division, squeeze outs or control and profit transfer agreements, re-organisations, mergers and transfers of companies, the entry or exit of shareholders, purchase price allocations or impairment tests.

Our transaction advisory services include financial and tax due diligences provided to potential buyers as well as vendor side services (vendor assistance and vendor due diligence) in preparation of a divestiture.

Contact:



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Appendix 1: Analyzed Valuations

Valuation Date in 2018

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
Linde AG	Linde Intermediate Holding AG	2018
SM Capital Aktiengesellschaft	SM Wirtschaftsberatungs AG	2018
Softchip AG	CargoWise GmbH	2018
SQS Software Quality Systems AG	Assystem Services Deutschland GmbH	2018
Oldenburgische Landesbank AG	Bremer Kreditbank AG	2018
Dürkopp Adler AG	DAP Industrial AG	2018
Stada Arzneimittel AG	Nidda Healthcare GmbH	2018

Valuation Date in 2017

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
SWS Spannwerkzeuge GmbH	Pittler Maschinenfabrik AG	2017
GfK SE	Acceleratio Capital N.V.	2017
Chorus Clean Energy AG	Capital Stage AG	2017
Kontron AG	S&T Deutschland Holding AG	2017
CONET Technologies AG	Conet Technologies Holding GmbH	2017
FIDOR Bank AG	3F Holding GmbH	2017
SinnerSchrader AG	Accenture Digital Holdings GmbH	2017
UNIWHEELS AG	Superior Industries International Germany AG	2017
WCM Beteiligungs- und Grundbesitz-AG	TLG Immobilien AG	2017
TLG Immobilien AG	WCM Beteiligungs- und Grundbesitz-AG	2017
Agroinvest Plus AG	AGRARINVEST AG	2017
Conwert Immobilien Invest SE	Vonovia SE	2017
XCOM AG	FinTech Group AG	2017
Pelikan AG	Pelikan International Corporation Berhad	2017

Creaton AG	Etex Holding GmbH	2017
Bremer Straßenbahn AG	Bremer Verkehrsgesellschaft	2017
DVB Bank SE	DZ Bank AG	2017
STRABAG AG	Ilbau Liegenschaftsverwaltung AG	2017
primion Technology AG	Azkoyen, S.A.	2017
KÖLN-DÜSSELDORF Deutsche Rheinschiffahrt AG	KD River Invest GmbH	2017

Valuation Date in 2016

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
PETROTECH AG	REG Germany AG	2016
IKB Deutsche Industriebank AG	LSF6 Europe Financial Holdings, L.P.	2016
MWG-Biotech AG	Eurofins Genomics B. V.	2016
Wincor Nixdorf AG	Diebold Holding Germany Inc. & Co. KGaA	2016
Colonia Real Estate AG	TAG Beteiligungs- und Immobilienverwaltungs GmbH	2016
Bochum-Gelsenkirchener Straßenbahnen AG	Holding für Versorgung und Verkehr GmbH	2016
Medisana AG	Comfort Enterprise GmbH	2016
VBH Holding AG	TLF Holding AG	2016
DMG Mori AG	DMG Mori GmbH	2016
DO Deutsche Office AG	DO Deutsche Office AG	2016
net mobile AG	DOCOMO Digital GmbH	2016
elexis AG	SMS GmbH	2016
Atevia AG	Cinetic GmbH	2016
Saint-Gobain Oberland AG	Horizon Holdings Germany GmbH	2016
Gruschwitz Textilwerke AG	pdm Holding AG	2016
NTT Com Security AG	NTT Communications Deutschland GmbH	2016
KENA Verwaltungs AG	Herr Harry Witt	2016

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year	Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
Analytik Jena AG	Endress + Hauser	2016			
Valuation Date in 2015					
Molda AG	Döhler Holding AG	2015	Hotel AG Wuppertal	Stadt Wuppertal	2014
AREAL Immobilien und Beteiligungs-AG	Thelen Holdings GmbH	2015	Curanum AG	Korian Deutschland AG	
Youniq AG	Corestate BenBidCo AG	2015	nextevolution Aktiengesellschaft	Die HeidelbergCapital Private Equity Fund II GmbH & Co. KG	2014
GFKL Financial Services AG	Garfunkel Holding GmbH	2015	Realtime Technology Aktiengesellschaft	3DS Acquisition AG	2014
PIXELPARK AG	MMS Germany Holdings GmbH	2015	Heidelberger Lebensversicherung AG	Heidelberger Leben Holding	2014
MeVis Medical Solutions AG	VMS Deutschland Holdings GmbH	2015	P&I Personal & Informatik AG	Argon GmbH	2014
Piper + Jet Maintenance AG	Piper Deutschland AG	2015	Travel Viva AG	Travel Viva Holdein AG	2014
Impreglon SE	GMT Investment AG	2015	Pulsion Medical Systems SE	Maquet Medical Systems AG	2014
Kässbohrer Geländefahrzeug AG	LuMe Vermögensverwaltung GmbH	2015	Etienne Aigner Aktiengesellschaft	Frau Evi Brandl	2014
Deutsche Postbank AG	Deutsche Bank AG	2015	Hanfwerke Oberachern A.G.	AGM Anlagen GmbH	2014
Forst Ebnath AG	Münchener Rückversicherungs-Gesellschaft	2015	Ferd. Rückforth Nachfolger Aktiengesellschaft	REWE-ZENTRALFINANZ eG	2014
Sky Deutschland AG	Sky German Holdings	2015	Design Hotels AG	Starwood Hotels & Resorts Worldwide Inc.	2014
Matth. Hohner AG	HS Investment Group Inc.	2015	Celesio AG	Dragonfly GmbH & Co. KGaA	2014
Ehlenbracht AG	Ehlebracht Holding AG	2015	IBS AG	Siemens Industry Automation Holding AG	2014
Jetter AG	Bucher Beteiligungsverwaltung AG	2015	Essanelle Hair Group AG	Hair Group AG	2014
AS Abwicklung und Solar-Service AG i.L.	Robert Bosch GmbH	2015	GSW Immobilien AG	Deutsche Wohnen AG	2014
Onvista AG	Boursorama S.A.	2015	Bien-Zenker AG	ADCURAM Fertigtbau Holding AG	2014
DAB Bank AG	BNP Paribas Beteiligungsholding AG	2015	CyBio AG	Analytik Jena AG	2014
Dresdner Factoring AG	abcfinance Beteiligungs AG	2015	Röder Zeltsysteme und Service AG	Zurmont Madison Deutschland GmbH	2014
Karlsruher Sanatorium AG	Marseille-Kliniken AG	2015	Buch.de Internetstores AG	Thalia Holding GmbH	2014
HOMAG Group AG	Dürr Technologies	2015	Vk Mühlen AG	Good Mills	2014
ADC African Development Corporation AG	Atlas Mara Beteiligungs AG	2015	Advanced Inflight Alliance AG	Global Entertainment AG	2014
WMF AG	Finedining Capital GmbH	2015	C.J. Vogel AG	Otto AG für Beteiligungen	2014
Augusta Technologie AG	TKH Technologie Deutschland AG	2015	Kabel Deutschland Holding AG	Vodafone Vierte AG	2014
			Sedo Holding AG	United Internet Ventures AG	2014
			Varta AG	GOPLA Beteiligungsgesellschaft mbH	2014

Valuation Date in 2013

Valuation Date in 2014

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year	Andreas-Noris Zahn AG (ANZAG AG)	Alliance Healthcare Deutschland Holdings 1 GmbH	2012
			Holcim (Deutschland) AG	Holcim Beteiligungs GmbH (Deutschland)	2012
Generali Deutschland Holding AG	Assicurazioni Generali S.p.A.	2013	IBS AG excellence, collaboration, manufacturing	Siemens Beteiligungen Inland GmbH	2012
GBW AG	Pearl AcquiCo Eins GmbH & Co. KG	2013	Derby Cycle AG	PON Holding Germany GmbH	2012
Terex Material Handling & Port Solutions AG	Terex Industrial Holding AG	2013	net-m privatbank 1891 AG	net mobile AG	2012
OCM German Real Estate Holding AG	Prime Office REIT-AG	2013	Tognum AG	Engine Holding GmbH	2012
Prime Office REIT-AG	OCM German Real Estate Holding AG	2013	RENERCO Renewable Energy Concepts	BayWa r.e. GmbH	2012
hotel.de AG	Hotel Reservation Service Robert Ragge GmbH	2013	AG		
CinemaxX AG	Vue Beteiligungs GmbH	2013	MCS Modulare Computer und Software Systeme AG	Franz Hensmann AG	2012
W.E.T. Automotive Systems AG	Gentherm Europe GmbH	2013	SHIGO ASIA AG	Crown Eminence Investment Limited	2012
Rücker AG	ATON Engineering AG	2013	Württembergische Leinenindustrie AG	VEM Vermögensverwaltungs AG	2012
Hansen Sicherheitstechnik AG	Kopex S.A.	2013	Graphit Kropfmühl AG	AMG Mining AG	2012
Computec Media AG	Marquard Media International AG	2013	Damp Holding AG	HELIOS Kliniken GmbH	2012
Dyckerhoff AG	Buzzi Unicem S.p.A.	2013	Comarch Software und Beratung AG	Comarch AG	2012
Ventegis Capital AG	Berliner Effektengesellschaft AG	2013	Utimaco Safeware AG	Sophos Holdings GmbH	2012
MAN SE	Truck & Bus GmbH	2013	Rathgeber AG	F.X. Meiller Beteiligungs-GmbH	2012
Douglas Holding AG	Beauty Holding Two GmbH	2013	Deutsche Postbank AG	DB Finanz-Holding GmbH	2012
Intelligence AG	NTT DATA EUROPE GmbH & Co. KG	2013	W.O.M. World of Medicine AG	ATON GmbH	2012
SCA Hygiene Products SE	SCA Group Holding B.V.	2013	INFO Gesellschaft für Informationssysteme AG	INFO Gesellschaft für Informationssysteme Holding AG	2012
HYMER AG	Erwin Hymer Vermögensverwaltungs AG	2013	Solarparc AG	SolarWorld AG	2012
Heiler Software AG	Informatica Deutschland AG	2013	Bausparkasse Mainz AG	INTER Krankenversicherung AG	2012
Reply Deutschland AG	Reply S.p.A.	2013	Landesbank Berlin Holding AG	Erwerbsgesellschaft der S-Finanzgruppe	2012
Reply S.p.A.	Reply Deutschland AG	2013	TDS Informationstechnologie AG	Fujitsu Services Overseas Holding Ltd	2012
7C Solarparken NV	COLEXON Energy AG	2013	Leica Camera AG	Lisa Germany Holding GmbH	2012
			Demag Cranes AG	Terex	2012
			Deutsche Immobilien Holding AG	Zech	2012
			Schramm Holding AG	Salvador AG	2012
			Versatel AG	VictorianFibre Holding GmbH	2012
Valuation Date in 2012					
Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year			
F. Reichelt AG	Fedor Holding GmbH	2012			
AIRE GmbH & Co. KGaA	AIG Century GmbH & Co. KGaA	2012			
Valuation Date in 2011					

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year			
PROCON MultiMedia AG	MHG Media Holdings AG	2011	Cembra Beteiligungs AG	Raiffeisen International Bank-Holding AG	2010
Medion AG	Lenovo Germany Holding GmbH	2011	ALTANA AG	Skion GmbH	2010
Süd-Chemie AG	Clariant AG	2011	Computerlinks AG	CSS Computer Security Solutions Erwerbs GmbH	2010
Triumph International AG	Triumph International Holding GmbH	2011	k.A.li-Chemie AG	Solvay k.A.li-Chemie Holding GmbH	2010
LHA Internationale Lebensmittelagentur Krause AG	LHA Holding A. und R. Krause GbR	2011	Themis Industries Group	Heliad Equity Partners	2010
REpower Systems SE	AE-Rotor Holding B.V.	2011	syskoplan AG	Reply S.p.A.	2010
FrankonoWest AG	TAG Immobilien AG	2011	Ergo Versicherung AG	Münchener Rückversicherungs-Gesellschaft AG	2010
W.E.T. Automotive Systems AG	Amerigon Europe GmbH	2011	Burgbad AG	ECZACIBASI	2010
A. Moxsel AG	VION N.V.	2011	Maihak AG	Sick Maihak GmbH	2010
Frogster Interactive Pictures AG	Gameforge AG	2011	Winkler+Duennebier AG	Körper AG	2010
INTERHYP AG	ING Direct N.V.	2011	Dom-Brauerei AG	Vertriebsgesellschaft deutscher Brauereien mbH	2010
GeneScan Europe AG	Eurofins ventures B.V.	2011	IDS Scheer AG	SAG Beteiligungs GmbH	2010
INTERSEROH SE	ALBA Group plc & Co. KG	2011	TA Triumph-Adler AG	KYOCERA MITA Corporation	2010
P&I Personal & Informatik AG	Argon GmbH	2011			
Internolix AG	netPULS Beteiligungsgesellschaft mbH	2011			

Valuation Date in 2010

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
Winter AG	Trüb AG	2010
Berlin-Hannoversche Hypothekenbank AG	Landesbank Berlin AG	2010
PC-Ware AG	PERUNI Holding GmbH	2010
GENEART AG	Applied Biosystems Deutschland GmbH	2010
Gasanstalt Kaiserslautern AG	EWG Energie-Wasser-Partner AG	2010
Actris AG	ACTRIS Beteiligungs GmbH & Co. KG	2010
Klößner-Werke AG	Salzgitter Mannesmann AG	2010
Christ Water Technology AG	Eimco Water Technologies GmbH	2010
HBW Abwicklungs AG	InBev Germany Holding GmbH	2010

Appendix 2: Missing Reports

The evaluation parameters of the following measures could not yet be taken into account in the study due to a lack of expert opinions.

Valuation target / controlled company / transferring entity	Majority Shareholder / controlling company / acquiring entity	Year
primion Technology AG	Azkoyen, S.A.	2017
Vereinigte Volksbank AG	Vereinigte Volksbank eG	2016
Lantana AG	Beichlinger Tier- und Pflanzenproduktions GmbH	2016
KWG Kommunale Wohnen AG	KWG Kommunale Wohnen GmbH	2016
e.optimum AG	e.optimum Aktienholding GmbH	2016
Barmer Wohnungsbau AG	Barmer Wohnungsbau GmbH	2016
Ariston Real Estate AG	Herr Hans-Dieter Lorenz	2016
AHT GROUP AG	Deutsche Projekt-Union GmbH	2016
Gontermann AG	Gontermann Holding GmbH	2016
TGE Marine AG	MES Germany Beteiligungs AG	2016
Creaton AG	Etex Holding GmbH	2016
Kurfürstin Holding AG	Kurfürstin GmbH & Co. KG	2015
PlanetHome AG	Planet Acquisition GmbH	2015
LTS Lohmann Therapie-Systeme	Dievini patch Beteiligungs GmbH	2015
Osteuropäische Zementbeteiligungs AG	Holcim Auslandsbeteiligungs GmbH (Deutschland)	2014
SEKISUI NordiTube Technologies SE	SEKISUI SPR Europe GmbH	2014
ODDSLINe Entertainment AG	ODDSLINe GmbH	2014
proALPHA Software Aktiengesellschaft	deltus Zwölfte AG	2013
biolitec AG	biolitec Unternehmensbeteiligungs AG	2012
Garant Schuh + Mode AG	ANWR Garant International AG	2012
Varta AG	Gopla Beteiligungsgesellschaft mbH	2012

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