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Article

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Do Damodaran's Multiples Value a Company Accurately? Evidence from Germany

Martin Husák[*]

Abstract:

The article examines the market valuation approach using industry market multiples as this method has recently attracted increasing interest from appraisers. It investigates whether constructing one's own industry market multiples for company valuation which are based on a market approach provides better results than using Damodaran's market multiples in terms of the resulting valuation accuracy. The study uses a sample of 162 German companies publicly traded in 2010–2019 and analyses some of the most frequently adopted multiples: EV/EBITDA, P/BV and P/E. Moreover, the presented results may guide the appraisers in selecting the most appropriate valuation approach. Based on the statistical error analysis, the results prove better valuation accuracy of the own-built market multiples compared to Damodaran's multiples. Nevertheless, this study is limited to German listed companies and should not be relied upon with respect to other European markets. Furthermore, its scope is limited to only 15 industries which are listed by Damodaran and subsequently included in the test sample.

Keywords: Business Valuation; Market Multiples; Damodaran; Valuation Accuracy.

JEL classification: G30; G32.

1 Introduction

Speaking of corporate finance, valuing a business is one of the main challenges that rise numerous questions about what valuation methods to use and whether the value of the given company is established unequivocally. While there are various valuation methods, this article concentrates on valuing a company using market multiples. The market multiples' method is often used to value a non-publicly traded company by comparing it with publicly traded comparable companies. Furthermore, the market multiples' approach is based on the assumption that identical assets have the same price ("the law of one price"); therefore, it could be established that the prices of similar companies should also be similar. There are several approaches to this method and the one analysed in this article is the use of comparable companies

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from the same industry, the so-called method of industry market multiples. Also, this method has lately been increasingly attractive to practitioners, such as financial analysts, to my surprise there are only a few empirical pieces of work (*e.g.* Lie and Lie, 2002; Schreiner and Spremann, 2007; or Nel *et al.*, 2013) that deal with the method of market multiples.

Every year, Damodaran (2022) publishes an analysis of industry market multiples on his website to be used by countless financial and investment analysts, academics, or the general public (*e.g.* Mařík *et al.*, 2018). Moreover, to the best of my knowledge, there is no empirical study that would analyse Damodaran's market multiples in more detail than Budský and Dvořák (2017); nevertheless, their paper is limited to the 40 largest U.S. companies. Damodaran's multiples are widely used as a substitute for more complex valuation methods, such as the standard Discounted Cash Flow (DCF) Analysis, as his calculations are intended as one of the freely available and reliable sources for market multiples. And if not used as the main valuation method, this method is being used at least for preliminary and supporting valuations. Compared to income approach valuation methods, market approach methods do reflect more recent value-relevant information perceived by the investors' expectations (*e.g.* Kaplan and Ruback, 1995; or Yoo, 2006) and rather avoid subjective adjustments to the company's value. Nevertheless, market multiples are often criticised for their inaccuracy (*e.g.* Kaplan and Ruback, 1995; or Fernandez, 2002) and because it is demanding to find comparable companies that are similar in profitability, growth, risk, capital structure, *etc*.

As there is no study that explicitly builds on Damodaran's industry multiples, this article attempts to analyse the valuation accuracy of multiples based on a self-generated sample compared to Damodaran's multiples. This article aims to show whether appraisers should access a database, extract the correct data and calculate industry market multiples themselves, or whether they should base their valuation on the freely available Damodaran's multiples. The presented article focuses mainly on the German publicly traded companies as the German market can be considered one of the most developed markets among the European countries and since there are already studies based on German companies. Unlike the sampled companies, Damodaran's multiples used in this study are based on the U.S. publicly traded companies. It could be argued that Damodaran also publishes information on market multiples based on European companies, more precisely on Western European companies, but in my opinion, these data are not sufficient for this type of research. Firstly, the European market is widely diversified, and it is not specified how these multiples are calculated. Secondly, there is not sufficient historical data to analyse as Damodaran began publishing the European multiples much later, and thirdly, in some aspects the U.S. market can be seen as more efficient and the benchmark for stock capital markets in general. It may be quite disquieting that there are several

differences between the U.S. and European companies analysed in this article. These aspects include economic development and prospects, corporate culture, regulatory framework, stock volume and liquidity, *etc*. The presented piece of work is limited to these aspects, although none of them gets analysed in detail. It is worth noting that caution should be exercised when using market multiples over time and space, as they should be used based on the same market data (in this case, the U.S. market) over the same time period. There can be many reasons (such as consistency), but the key reason is that markets evolve over time and so does the economic situation. Therefore, if there were no consistency in calculating market multiples in different years using a different base, the result would not be satisfactory.

This article analyses three widely used market multiples as set out in the following sections, and thus contributes to the field of market multiples valuation, often referred to as the relative valuation method. The article is structured as follows. The next section deals with the relevant literature, followed by a description of the data and adopted methodology. The concluding section presents empirical findings and key conclusions.

2 Literature Review

The market-based valuation approaches may support the DCF-based valuation methods, as Kaplan and Ruback (1995) show using the evidence of highly leveraged transactions, where the DCF approach values companies with similar valuation accuracy as the market multiples. Similarly, Gilson *et al.* (2000) estimated the value of companies that reorganise in bankruptcy and concluded that the DCF model arrives at a similar outcome as the market multiples valuation. The importance of using different valuation methods is crucial because generally accepted valuation methods, such as DCF, are not always correct. Green *et al.* (2016) found many errors and dubious findings in sell-side analysts' valuation reports using the DCF-based valuation methods. Demirakos *et al.* (2004) see the use of market multiples in more stable sectors, where accounting better captures the value of the firm.

Lie and Lie (2002) are among the first to compare the valuation accuracy of several market multiples with a focus on forward multiples, leading to higher accuracy than historical multiples. Likewise, Liu *et al.* (2002) devoted their research to various value drivers, finding that forward multiples perform better than historical ones. In contrast, combining market multiples valuation outcomes improve valuation accuracy for historical variables rather than for forward multiples (Yoo, 2006). Nel *et al.* (2013) compared equity and entity multiples to determine which approach is more accurate and whether there is a potential improvement in accuracy. Besides, analyst reports revealed preferences for certain market multiples for specific sectors

(Fernandez, 2002). When deciding on the selection of particular multiples according to Gupta (2018), the accuracy of book value multiples is higher than that of the multiples based on earnings.

The selection of comparable companies at the industry level seems acceptable, as analysed by Alford (1992). Based on the price-earnings multiple he concludes that this approach is relatively effective at the second level of the industry classification. On the other hand, even industry classification can be crucial for market multiples valuation. Eberhart (2004) examined the accuracy of market multiples in nine different industry classifications and found that four of them carry the utmost accuracy. Also, Serra and Fávero (2018) analysed the homogeneity of companies by industry and country of origin.

Next to the selection of comparable companies, the selection of a mean value for determining market multiples is critical as well. Baker and Ruback (1999) focused on estimating industry multiples and the way to select financial performance measures and found out that the harmonic mean is the most reliable mean for determining industry multiples; and that the simple mean leads to overestimated values. In examining valuation accuracy, Dittmann and Maug (2008) analysed different error measures in testing the valuation accuracy of market multiples and showed that even the selection of an error measure bears a major importance.

In the European context, Schreiner and Spremann (2007) examined the valuation accuracy of European companies compared to U.S. companies. The authors found equity multiples outperforming entity multiples, knowledge-related multiples outperforming traditional multiples, and finally, forward multiples to be more accurate than these based on historical data. The study found a high degree of similarity together to the U.S. dataset. Further, Chullen *et al.* (2015) analysed whether consistency between the numerator and denominator in multiples improves valuation accuracy using different aggregation methods on a sample of German companies. They found higher valuation accuracy for consistently constructed multiples compared to inconsistent ones. Following the introductory section on the use of U.S. multiples on European companies, even in Brazil, practitioners tend to use U.S. companies' industry multiples as a variable for valuing local companies (Serra and Fávero, 2018).

As already mentioned, Budský and Dvořák (2017) are, as far as I know, the only authors to analyse Damodaran's multiples. Nonetheless, the study is limited to the 40 largest publicly traded U.S. companies and has led to these companies being undervalued using Damodaran's multiples

3 Research Design

3.1 Research question

When valuing European companies, academicians and practitioners face the inevitable question of whether or not to take advantage of Damodaran's industry market multiples. The research question that arises from this consideration is then:

> RQ: When valuing a company using the market multiples method, can better results be obtained by using Damodaran's multiples of American companies instead of building our own industry multiples for German companies?

3.2 Sample selection

This research is limited to European companies and data provided by Damodaran (2022) and focuses its concern on the European market and more specifically on German publicly traded companies listed on the following stock exchanges: Börse München, Börse Stuttgart, Deutsche Börse AG, Börse Düsseldorf, Hamburg Stock Exchange, Hannover Stock Exchange, and Frankfurt Stock Exchange. German listed companies were chosen because to the best of my knowledge German market is one of the most developed in Europe (Schreiner and Spremann, 2007; Chullen *et al.*, 2015). All the variables were extracted from an S&P Capital IQ (2022) database where all necessary fundamental drivers are available and secondly from the Damodaran's (2022) website, where he collects all the market multiples data. Descriptive statistics of the sample are reported in Tab. 1.

Tab. 1 Descriptive statistics of the sample (in EUR million)

	Median	Mean	1st quartile	3rd quartile	No. of observations
Sales	211.2	2,455.8	58.2	854.9	1,538
EBITDA	17.7	351.8	2.6	84.1	1,538
EBIT	9.8	186.3	1.2	49.4	1,538
Net income	5.7	73.3	0.5	30.0	1,538
Total assets	194.9	3,413.0	47.3	747.8	1,527
Market capitalisation	169.0	1,989.9	39.0	790.7	1,400
Book value of equity	82.0	1,003.8	19.4	315.2	1,535
Enterprise value	159.8	2,553.3	28.1	780.9	1,620

Source: S&P Capital IQ, 2022 + authorial computation.

The challenge in selecting the companies in the sample was to identify industries containing at least five entities; this way, the whole market multiples analysis is free from bias. In addition, only those industries listed by Damodaran (2022) had to be included in the sample. The next step was to keep in the sample only companies that have shown positive earnings for at least three years for the company to meet the going concern assumption. Also, banking and other financial institutions that do not report $EBITDA$ as a financial indicator were excluded from the sample. The initial selection of 735 firms was narrowed down to a final set of observations representing 162 companies operating in 15 industries that met all the aforesaid criteria. Selected companies are analysed in the ten-year horizon 2010–2019 to avoid seasonality, market anomalies and overreactions (*e.g.* De Bondt and Thaler, 1987) caused by the financial crisis or the outbreak of COVID-19 pandemic.

3.3 Methodology

The market multiples valuation in this article is in line with the standard approach (*e.g.* Lie and Lie, 2002; or Schreiner and Spremann, 2007). The steps that derive the company's value are as follows: (i) deciding what value of the given company is required; (ii) determining and calculating a value driver that is consistent with the selected value; (iii) identification of comparable companies; (iv) finding a mean value of multiples of comparable companies; and (v) valuing the company by multiplying that mean by the value driver of the company.

In general, two types of company value can be sought: either the entity value by using the entity-based multiples with respect to the value of the company as a whole (for all its investors – both the shareholders and the creditors) and determined as the enterprise value (EV), or the equity value by using the equity-based multiples and targeted only at owners themselves, seeking the market value of shares (P). As mentioned by Chullen *et al.* (2015), entity multiples should contain a specific entity value driver, such as EBITDA. Conversely, for equity multiples, the denominator should be an equity value driver, such as earnings (E) or book value of equity (BV). This article analyses three specific market multiples – EV/EBITDA, P/BV and P/E. The selection of these specific indicators is based on previous research (*e.g.* Alford, 1992; Kaplan and Ruback, 1995; or Gupta, 2018) and because there is no precise evidence that one is better than the other. However, there is more intuition about using such multiples in previous research. Kim and Ritter (1999) ranked EV/EBITDA as more accurate for advanced companies than for IPOs. Furthermore, Liu *et al.* (2002) found sales value drivers to perform the worst. Lie and Lie (2002) found P/BV multiple to yield better results than the other multiples examined.

Variables of multiples are determined as follows: EV is calculated on the same basis as proposed by Damodaran (2022), adding the book value of debt to the market

capitalisation. It could be argued that EV should be adjusted for excess cash, but according to Lie and Lie (2002), adjusting for cash levels would not improve accuracy. All denominators are calculated on the basis of annualised values as of December 31 of the given year except for P and partly also EV. Market capitalisation is derived from April 1 of the following year because the earnings of these companies are already expected to be publicly available (similar to Alford, 1992; Eberhart, 2004; Schreiner and Spremann, 2007; and Liu *et al.*, 2002). For P, the market capitalisation is divided by the number of shares outstanding at that date. The share price reflects current shareholders' perceptions of the company's value, provided the markets are efficient (Fama, 1970). For this case in particular, some previous research shows that German capital markets are efficient (*e.g.* Plíhal, 2016; Mittnik and Rieken, 2000; or Nugent, 1990).

The value of a company is determined by Formula (1):

$$V_{it} = X_t \times \alpha_{it}, \tag{1}$$

where V represents the equity value of a company i at time t, X is an equity-based multiple and α is a value driver of the company. When working with entity-based multiples, X^e, it is necessary to subtract the book value of debt, D, as shown in Formula (2):

$$V_{it} = X_t^e \times \alpha_{it} - D. \tag{2}$$

Given the literature on the identification of comparable companies, the industry level seems to be used the most, as it includes companies with similar risk exposure and growth. The industry used here is based on the S&P 500 classification and is in line with the Damodaran industry classification. For this study, three steps need to be followed to determine industry multiples: (i) multiples of companies that were negative were excluded from the sample in order to use this valuation method (*e.g.* Chullen *et al.*, 2015); (ii) to build a multiple, in the analysed year there are at least four companies for a specific industry; and (iii) the mean value of the industry market multiple is determined by the median calculated on an out-of-sample basis, meaning the valued company's multiple gets omitted (*e.g.* Yoo, 2006). The rationale for choosing the median is that it is the most accurate measure according to Lie and Lie (2002), Eberhart (2004), Dittmann and Maug (2008), Nel *et al.* (2013), or Gupta (2018) and it can eliminate the effect of outliers. As mentioned in Section 2, Baker and Ruback (1999) stated that the harmonic mean is better for determining industry multiples, but its calculation on such a large amount of data is more complex and it is definitely a subject for further research.

Formula (3) is followed to estimate the equity value of a company, $\hat{V}$, using equity-based multiples built on comparable companies' multiples, $\hat{X}$:

$$\hat{V}_{it} = \hat{X}_t \times \alpha_{it}, \tag{3}$$

or when using entity-based multiples, $\hat{X}^e$:

$$\hat{V}_{it} = \hat{X}_t^e \times \alpha_{it} - D. \tag{4}$$

Calculated medians of industry multiples of the sample are presented in Panel A of Tab. 2. Damodaran's approach is slightly different, calculating multiples by aggregating the nominators and denominators of multiples of all companies in the industry as of January 1 of that year, regardless of the publication of the financial statements. Another difference in the comparison of the sample and his multiples is the number of companies included in the calculations, as seen in Panel B of Tab. 2.

The underlying idea of this article is to estimate the values of the sampled companies using own multiples created on the basis of comparable companies in the sample compared to the estimated values of the sampled companies using Damodaran's multiples. To do so, it is necessary to compare the resulting values of companies with the observed data from the capital markets. To compare the accuracy of multiples used in this article, valuation errors are measured. Valuation errors are based on the natural logarithm of the company's estimated value relative to the observed value. The valuation error is calculated as follows:

$$Valuation\ error = \ln \frac{\hat{V}_{it}}{V_{it}}. \tag{5}$$

The natural logarithm allows a balanced comparison of underestimation and overestimation, it has been used in several research papers (*e.g.* Kaplan and Ruback, 1995; Liu *et al.*, 2002; Eberhart, 2004; or Chullen *et al.*, 2015). Dittmann and Maug (2008) concluded that the logarithmic error measure leads to the most precise and least skewed results. Valuation errors are then pooled together, and the median valuation error is found. Kaplan and Ruback (1995), Lie and Lie (2002), Dittmann and Maug (2008), and Chullen *et al.* (2015) found that median valuation errors for market multiples are very close to zero and show much better results than simple arithmetic mean. Nel *et al.* (2013) revealed that median measures valuation errors the most appropriately.

In order to compare the observed calculations, the root-mean-square error (RMSE) is calculated, which looks for comparability of estimated data with the observed data by measuring the magnitude of valuation errors. The smaller the error, the more accurate the valuation estimate (*e.g.* Dittmann and Maug, 2008; or Gupta, 2018). RMSE is also supported by the standard deviation of valuation errors and standard error, which represents the standard deviation of the sample distribution. Furthermore, the results will be analysed within a fraction of 15% of valuation errors from the calculated median.

Tab. 2 Descriptive statistics of industry multiples

Panel A: Sample data	EV/EBITDA		P/BV		P/E	
	No. of obs.	Median	No. of obs.	Median	No. of obs.	Median
Advertising	35	14.3	40	2.5	31	25.7
Apparel, Accessories and Luxury Goods	49	11.9	57	2.3	47	20.2
Auto Parts and Equipment	96	7.2	98	1.9	93	14.7
Building Products	52	7.7	52	1.3	49	14.3
Communications Equipment	48	10.5	55	1.6	32	14.5
Electrical Components and Equipment	44	15.5	55	2.6	35	23.4
Electronic Equipment and Instruments	103	12.5	111	2.4	96	20.9
Industrial Machinery	289	10.6	312	2.0	266	19.5
Integrated Telecommunication Services	40	7.3	38	1.5	34	23.3
IT Consulting and Other Services	174	13.4	203	3.3	167	23.2
Movies and Entertainment	78	10.0	92	1.9	69	17.3
Multi-Utilities	49	11.6	50	1.4	43	17.6
Packaged Foods and Meats	47	8.5	50	1.4	43	19.2
Semiconductor Equipment	38	11.8	52	1.8	34	21.1
Specialty Chemicals	74	9.2	74	1.8	69	18.4
Panel B: Damodaran's data	**EV/EBITDA**		**P/BV**		**P/E**	
	No. of obs.	**Mean**	**No. of obs.**	**Mean**	**No. of obs.**	**Mean**
Advertising	427	10.1	427	5.5	427	36.8
Apparel, Accessories and Luxury Goods	566	12.1	566	3.5	566	25.0
Auto Parts and Equipment	589	7.0	589	2.4	589	21.6
Building Products	413	11.8	413	3.4	413	40.2
Communications Equipment	1,085	11.7	1,085	2.8	1,085	58.3
Electrical Components and Equipment	1,057	12.5	1,057	3.8	1,057	28.3
Electronic Equipment and Instruments	1,610	11.3	1,610	2.2	1,610	44.8
Industrial Machinery	1,215	12.2	1,215	3.3	1,215	38.2
Integrated Telecommunication Services	726	7.3	726	2.1	726	39.2
IT Consulting and Other Services	553	15.4	553	5.6	553	40.4
Movies and Entertainment	876	11.0	876	3.1	876	41.0
Multi-Utilities	754	9.8	754	1.8	754	24.1
Packaged Foods and Meats	966	12.1	966	2.9	966	31.7
Semiconductor Equipment	350	12.1	350	2.8	350	38.8
Specialty Chemicals	911	11.4	911	3.6	911	27.8

Source: S&P Capital IQ, 2022; Damodaran, 2022 + authorial computation.

4 Empirical Results and Discussion

Based on the above-introduced procedure of valuation errors analysis, the estimates of companies' values were first made and then, according to Formula (5), the modelled data were compared with historical data, which led to a valuation error for each observation. To better understand the results, let's determine the two datasets examined first as a sample-based dataset reflecting the analysis of median multiples calculated on sampled companies, and next as a Damodaran-based dataset calculated on Damodaran's multiples. At the first level of analysis, valuation errors were pooled together based on the median by specific industry and summarised in Tab. 3, where the median valuation errors of both datasets are presented.

Tab. 3 Median valuation errors of industry multiples

	EV/EBITDA			P/BV			P/E		
	#	MVES	MVED	#	MVES	MVED	#	MVES	MVED
Advertising	35	0.092	−0.466	40	0.000	0.555	31	0.000	0.325
Apparel, Access. and Lux. Goods	49	0.035	0.021	57	0.015	0.407	47	−0.001	0.164
Auto Parts and Equipment	96	−0.011	0.065	98	0.020	0.203	93	0.001	0.362
Building Products	52	−0.012	0.457	52	0.000	0.694	49	0.006	1.027
Communications Equipment	48	−0.030	0.139	55	0.003	0.703	32	−0.047	1.401
Electrical Components and Eq.	44	0.123	−0.156	55	0.186	0.366	35	0.794	0.633
Electronic Eq. and Instr.	103	0.005	−0.205	111	0.022	−0.083	96	−0.022	0.649
Industrial Machinery	289	0.001	0.119	312	0.004	0.485	266	0.013	0.620
Integrated Tel. Services	40	0.037	−0.013	38	0.038	0.542	34	0.043	0.484
IT Cons. and Other Services	174	0.009	0.186	203	−0.003	0.569	167	0.018	0.918
Movies and Entertainment	78	0.000	0.091	92	0.038	0.382	69	−0.049	0.852
Multi-Utilities	49	0.265	−0.216	50	0.139	0.030	43	−0.022	0.311
Packaged Foods and Meats	47	0.006	0.370	50	0.005	0.730	43	−0.002	0.403
Semiconductor Equipment	38	0.177	−0.313	52	0.059	0.528	34	0.192	0.638
Specialty Chemicals	74	0.060	0.230	74	−0.001	0.629	69	−0.005	0.593

Source: S&P Capital IQ, 2022; Damodaran, 2022 + authorial computation.
Note: # represents the no. of observations, MVES is the median valuation error of the sample-based dataset, and MVED is the median valuation error of the Damodaran-based dataset.

The negative value of the median valuation error represents the undervaluation of companies based on estimates, respectively, the positive value shows their overvaluation. In this analysis, it is more important whether the results are accurate, and therefore I analyse how far is the calculated value from zero because the most accurate estimates are those where the median valuation error is very close to zero.

Zero means no bias, so the results can show how the estimates are biased. As already mentioned, the median should be a more robust measure for mitigating outliers than the simple average. As is evident from Tab. 3, not all industries achieved better valuation accuracy for the sample-based dataset than the Damodaran-based dataset. The evidence relates to EV/EBITDA in three cases and in one case to P/BV and P/E. Based on both datasets, the most accurate is the EV/EBITDA multiple, because in the case of the other two multiples, Damodaran-based multiples are much more distorted. The P/E multiple in the Damodaran-based dataset exceeds 100% in two cases, which represents a high valuation inaccuracy.

In order to determine which valuation approach is more accurate based on the above studies and to provide valuable insights, all valuation errors are pooled and compared based on market multiples. All the supporting statistics are summarised in Tab. 4 where the relative dispersion of valuation errors is measured by their median and supported by the aforementioned standard deviation, standard error, RMSE and the fraction of errors within 15%, in order to understand, how the data cluster around the median. The fraction of errors within 15% deviation from zero is also important measure because it shows how many observations in the sample were the closest to the zero valuation error. In all the cases, Tab. 4 exhibits that the median valuation error for the sample-based dataset is much closer to zero than for the Damodaran-based dataset, which means that the sample-based multiples produced more accurate valuations than their counterparts.

Tab. 4 Statistics of industry multiples' valuation errors

Panel A: Sample multiples

	No. of obs.	Median valuation error	Std. dev	Std. error	RMSE	Skewness	Kurtosis	Fraction < 0.15
EV/EBITDA	1,216	0.014	0.709	0.020	45.677	−0.978	5.183	0.240
P/BV	1,339	0.022	0.800	0.022	8.440	−0.489	2.519	0.183
P/E	1,108	0.002	0.926	0.028	103.918	−0.252	4.302	0.239

Panel B: Damodaran's multiples

	No. of obs.	Median valuation error	Std. dev	Std. error	RMSE	Skewness	Kurtosis	Fraction < 0.15
EV/EBITDA	1,216	0.093	0.670	0.019	46.731	−0.883	3.172	0.224
P/BV	1,339	0.453	0.781	0.021	8.308	−0.488	2.078	0.130
P/E	1,108	0.593	1.060	0.032	112.928	0.180	2.859	0.108

Source: S&P Capital IQ, 2022; Damodaran, 2022 + authorial computation.

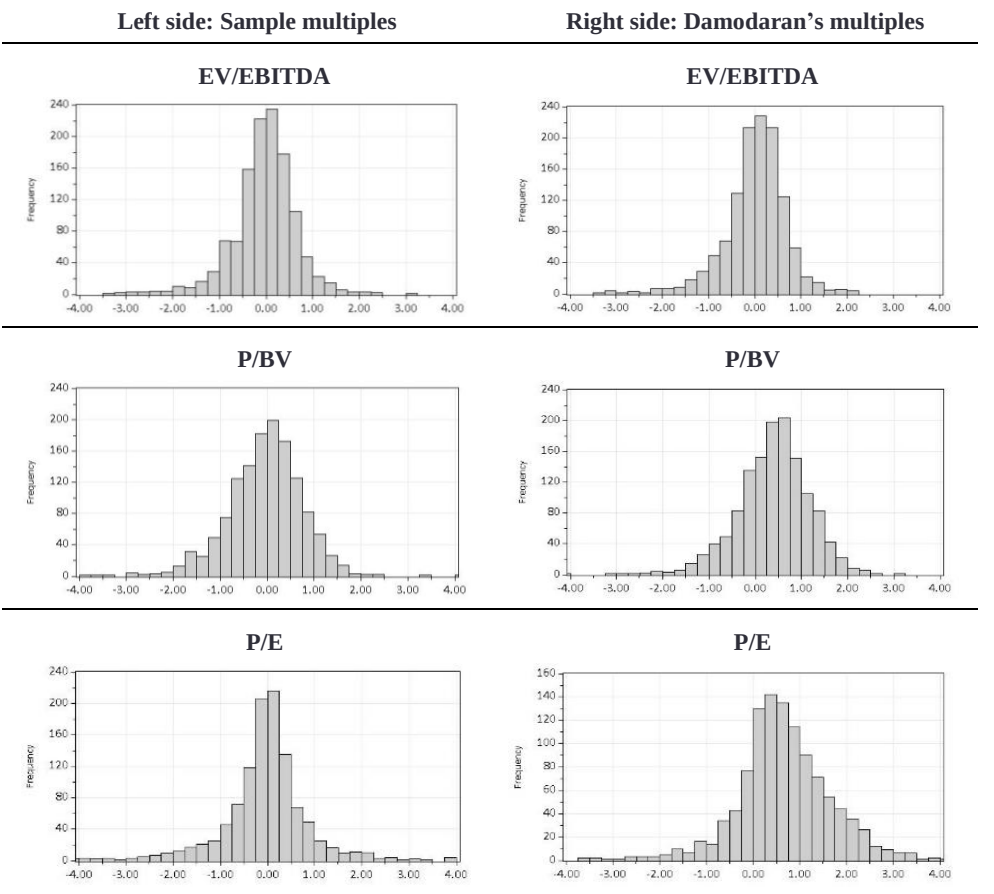
In the case of the sample-based P/E multiple, there is only 0.002 median valuation error, while in the case of Damodaran multiple the error is 0.593 (meaning the

median valuation is biased by 59.3%). Kaplan and Ruback (1995) reported a median valuation error of −0.181 in their study. Chullen *et al.* (2015) found a valuation error using the median of 0.001 for EV/EBITDA and zero for P/E, which is quite consistent with the findings of this study. Finally, Dittmann and Maug (2008) arrived at the median valuation error of 0.002 of median industry multiples. As can be seen in Tab. 4, the standard deviation and standard error are higher for EV/EBITDA and P/BV of the sample-based multiples, which displays a higher degree of variability of valuation errors for the sample-based dataset than for the Damodaran-based valuation errors. One explanation is that this could be reduced by removing outliers from the sample. However, since I wanted the analysis to be biased as little as possible, all the data were ultimately kept in the dataset. Furthermore, the higher value of RMSE for the sample-based dataset is only in the case of P/BV, leading to 8.440 compared to 8.308. Nevertheless, it is important to emphasize that all these supporting statistics (standard deviation, standard error, and RMSE) are rather descriptive, as their values do not differ significantly. The most important measure that renders the results more reliable is the fraction of less than 15%. The positive discovery is that for all the cases, this measure is higher for the sample-based dataset than for the Damodaran-based case; this shows a higher number of valuation errors is approaching zero. This study provides evidence that EV/EBITDA results are very close when comparing the 22.4% frequency of the Damodaran-based dataset and 24% of the sample-based dataset of this fraction. For example, Kaplan and Ruback (1995) concluded a performance measurement within 15% valuation error for comparable companies in the same industry of 37.7%.

It is worth noting that the valuation errors are clustered around zero with evidence of skewness and kurtosis, as shown in Tab. 4. This fact is even more detailed in Fig. 1 of the individual distributions of the plotted valuation errors. The histograms of each multiple are divided into the left-hand side by the sample-based multiples and the right-hand side by the Damodaran-based multiples. These histograms allow comparability between the sample-based and Damodaran-based pools of the valuation errors. As can be seen from the histograms, there are outliers in the sample; these outliers were not removed from the sample to avoid potential data distortion. Apart from the effect of outliers, the data do not exhibit a normal distribution pattern. Both EV/EBITDA datasets are negatively skewed and remain very close to unity which could be described as highly skewed. In the case of the P/BV multiple, both datasets are relatively mirror-like skewed, both close to −0.5. The P/E multiple is the only one that differs slightly for both datasets. While the skewness of the P/E multiple of the sample-based dataset is tailed to the left-hand side, the corresponding multiple for the Damodaran-based dataset is skewed to the right-hand side as the tail on the right-hand side is thicker. Regarding kurtosis, none of the observed results is negative, which means the datasets follow a leptokurtic

distribution. The highest kurtosis is for EV/EBITDA and P/E, both from the sample-based dataset.

Fig. 1 Empirical valuation errors distribution



Source: S&P Capital IQ, 2022; Damodaran, 2022 + authorial computation.

Market capitalisation and share prices in general can be strongly influenced by the level of market efficiency, and therefore a lower degree of market efficiency may present an unreliable value that is critical to the results when valuing using the market multiples method. The ownership structure of a company can also affect the enterprise and equity value. This should be borne in mind and the resulting value should not be taken as a final value and should be examined further. Both of these caveats are not analysed further in this research and are used as a functional assumption.

In summary, the research question set out in Section 3 focuses on the practical use of freely available sources of market multiples rather than on the literature review which represents the research on market multiples conducted to date. Thus, the results obtained in this study point towards a negative answer to the research question as for the valuation of German companies, to some extent they offer better valuation accuracy for market multiples constructed on our own when compared to using Damodaran's multiples.

5 Conclusion

The primary focus of this article was to investigate whether building own industry market multiples for valuing a company based on the market approach provides better results than using Damodaran's generally accepted market multiples. The adopted empirical study has used a data sample of 162 companies traded on the German capital market in the years 2010–2019. The companies in the sample are examined on both datasets – market multiples based on the sample and market multiples based on Damodaran's data.

The results show that creating own market multiples based on the industry classification yields in terms of valuation accuracy better results than using Damodaran's multiples. I have to admit that there is a negligible difference when valuing a company using the EV/EBITDA multiple, as shown by the 15% fraction of the valuation errors close to zero. For the other two examined multiples, P/BV and P/E, the significance is greater. Moreover, the presented results can show the appraisers what approach to take. If they do not have direct access to a quality database or need to save costs and follow Damodaran's multiples, they may end up with a relatively well-valued company. On the other hand, building own market multiples can bring better results, so this needs to be beard in mind.

This study is limited to German listed companies and should not be relied upon in other European markets. Furthermore, it is limited to only 15 industries that are reported by Damodaran and which were included in the tested sample. For this research, it would be appropriate to narrow down the industry levels according to the industry classification, but on the other hand, this is not feasible, as some clusters would then contain less than five companies, and this would lead to distortions. Further research could provide better results by selecting comparable companies based on criteria other than industry classification, such as growth, risk, profitability, *etc*. Adjusting outcomes from financial statements or using forward multiples that are not based on historical accounting performance and better reflect future expectations could also produce better results, notwithstanding the fact that there is limited data on the European market.

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