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Risk Relevance of Fundamental Investment Criteria

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Abstract

This paper aims to show the risk relevance of fundamental investment criteria. Based on the stock selection criteria of Benjamin Graham, this paper analyses the relation between selected stocks and their risk according to the beta factor. It does this by using statistical analysis methods. Beside the question whether the selected stocks have a lower risk then the overall market, the paper looks on the information that is given to the investor based on the selection criteria. With this it examines whether the criteria give the investor a clear decision direction rather than different information regarding an investment case or not.

Keywords: Finance; Stock; Selection; Criteria; Graham; Investment

Introduction

Historical background

Since the 1930s criteria for fundamental investment decisions were created based on experience and later on research. One of these were the criteria formed by Columbia Business School professor Benjamin Graham and David Dodd after the stock market crash in 1929 [1]. This resulted in the book *Security Analysis* [2]. In this book, Graham and Dodd examined some key criteria to analyze stocks that will outperform the market. The key principle that was applied is the margin of safety. This margin is given by a significant gap between the stock price and the intrinsic value of the stock. The margin should protect the investor from the downturn of the financial market. This results in a strategy to invest in companies that have a lower price than its intrinsic value according to certain analysis methods and selection criteria [3].

Later, researchers analyzed the criteria to value stocks and make a stock selection that is willing to outperform the market. Current research looked at the selection criteria of Graham and Dodd, analyzed the potential of the criteria, see for that Singh, Kaur and other [4,5]. Most of the studies examined different ratios that were used in order to select stocks that generate a value premium [6-10].

The volatile financial market makes it necessary for investors to reduce the risk of their investments [11]. By performing value investment, the investor searches for a value premium and buys stocks below its internal value. This value premium that is purchased, gives the investor according to Yee [12] a margin of safety.

This research paper wants to indicate whether the stock selection criteria that were mainly published by Graham and Dodd, give the investor a clear base for their decisions. Furthermore, it is important to know whether these criteria make the investor choose stocks that have a lower risk then the rest of the market. By knowing this, investments could be used in order to back up the total portfolio and reduce the overall risk. This can be interesting for investors, especially for institutional investors. Those often need to fulfill certain policies that are linked to the risk of their portfolio in order to get a specific rating from a rating agency [13].

Problem statement

.The way investors see the stock market changes from time to time. In time of crisis like 1929, 2000 and 2008, investors see the market as inefficient. However, when the market is going up, most investors would see the market as efficient and believe in the prices. This change in the view of the market leads to the concept of "Mr. Market". This means that the market is not all time showing the right price for an asset which leads to the fact that the price should not be the main selection criteria for a stock (Ibid). According to Rea [14] and Oppenheimer, the selection criteria of Benjamin Graham are based on the idea of maximizing the reward to risk ratio of the selected stocks. The selection should be based on fundamental ratios for business valuation.

This results in the investment approach that is focused on fundamental analysis. This view can be devided in value and growth investing which were also merged by some investors [15]. Hereby, the value perspective wants to examine the value of a stock or company in order to reduce the risk for the defensive and enterprising investor. Current research on this topic revealed that investors, who followed the selection criteria of value investing, earned 3 to 3.5% more return than the market. Oppenheimer [16] showed that investors who followed the criteria of Benjamin Graham gained a mean annual return of 38 % in the period from 1974 to 1981. Since this could also relate to general market conditions, such research were done also in recent years, see for that. Xiao and Arnold applied Grahams criteria of the *Net Current Asset Value* on data from the London Stock Exchange (LSE) for the period from 1981 to 2005. They obeserved that stocks, that followed the selection rules, had positive market returns over a holding period of five years. In further studies, the criteria were also tested on other data sets such as from the Malysian stock market. Results showed also here that in a period from 2000 to 2009 stocks selected by the criteria generated higher returns than the market index in almost every year (Ibit).

However other studies such as the one from Balik and Mehran showed a lack of abnormal returns of stocks selected by using Benjamin Graham's criteria. This lead to the question whether these stocks have at least a lower risk for the investors if they do not lead to abnormal returns. This could also be in line with the statement that value investment is for the defensive and enterprise investor. According to Rea this stocks should have a higher return to risk ratio which implies a lower risk. In recent times the financial markets got more volatile and with that also the risk of investing inceased. The main concept that is used to reduce the risk is the conept of asset allocation [17]. This paper wants to go further and test whether the risk of stocks, selected by fundamental value investment criteria, will also reduce the risk of an investment in comparison with the overall market.

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Research questions

The purpose of this study is to investigate whether stock selection criteria for value investing, discussed in current research, give the same decision direction for investors. Furthermore, the study wants to examine whether the risk of the selected stocks is lower as the overall market risk. Through these questions, the reader gains more understanding of selection criteria that can be used to select stocks that outperform the market and might reduce the risk for the investor. Since other scholars stated already that stocks which are selected by value investing criteria outperform the market, this study wants to focus on the aspect of risk and analyze whether this investment approach is for the conservative investor. The study examines whether this stocks that are selected by these criteria have a lower risk in changing share prices and with that a lower potential decline in the price. This leads to the following research questions:

RQ1: Which decision direction does these criteria's give the investor?

RQ2: Which risk do the selected stocks have in comparison to the overall market?

In addition to this research questions, the paper will present hypothesizes that show a gap in current research and test this hypothesizes. This test will further lead to the answer of the research question.

Theoretical Framework

Theoretical foundations related to value investment

In the past, the efficient market hypothesis was widely accepted among scholars in economics and finance. According to this theory, neither technical analysis nor fundamental analysis would enable investors to achieve returns above the market returns. This would imply that the risk of the company would be integrated into the stock price (Ibid). Malkiel concluded in his research that the collective judgment of investors will make mistakes from time to time. This results in irregularities when it comes to pricing and unpredictable patterns (Ibid). Furthermore, Grossman and Stiglitz [17] stated that the market cannot be efficient because this would make it unnecessary to uncover information about the financial market. Furthermore, Fama stated that there are three types of information efficiencies. Strong information efficiency means that all information has a direct influence on the price and is with that at every time integrated in the price. The next type is the semi strong information efficiency. This type explains that public information is included in the stock price; however insider information is not included in the stock price. In this case the market shows inefficiency. The third type is described as weak efficiency. In this case, not all information has a direct impact on the stock price and is therefore also not included in it. This last two types support the research of Malkiel as well as the one from Grossman and Stieglitz who presented arguments against an efficient capital market.

The risk of an investment can be divided into systematic risk that is induced by the market and unsystematic risk (risk that is independent from general market movements) [18]. Fiegenbaum and Thomas found that the risk return paradox on of Bowman, which describes a negative association between risk and return, holds not true if the beta is used as a risk measure. Furthermore, current research has shown that beta is an increasing function of leverage ratio, volatility, growth opportunities and market price of risk and a decreasing function of earnings level, earnings growth rate and tax rate [19,20].

The reason for using beta as a measure for risk is that the unsystematic risk can be avoided through asset allocation [21]. This study looks first on the beta and why it can be used in order to define an asset as low or high risk investment. The concept of the beta factor is based on regression analysis or can be calculated indirectly by using the Capital Asset Pricing Model (CAPM). The CAPM provides the opportunity to measure the relation between return and risk of an asset.

The Beta β_{iM} is according to Fama and French the covariance of the return R_i of an asset i with the market return R_M, divided through the variance of the return of the market R_M.

$$\beta_{iM} = \frac{\operatorname{cov}\left(R_i, R_M\right)}{\sigma^2\left(R_M\right)} \quad (1)$$

Due to the fact that the market beta of an asset i is also a part of the regression of its return on the market return, it can be interpreted in the following way. The beta can be seen as a measure for sensitivity of asset's return to the variation in the market returns. Another interpretation that was stated by Fama and French is that the risk which is measured by the variance of the returns of an asset (this variance is the dominant factor of the beta) can be seen as a weighted average of assets covariance risks in the market.

In other terms due to this fact, β_{iM} can be seen as proportional to the risk that occur when investing a dollar in an asset i that contributes to the market portfolio. To sum up this part, it can be said that a beta factor of 1 means, that the stock fluctuates with the market. A beta factor of more than "1" indicates a higher systematic risk of the asset then the market and vice versa.

According to the theory of Modigliani and Miller, is an asset worth to be acquired by a firm if the expected rate of return on investment exceeds the interest rate. If this is the case, the investment would increase the value of owner's equity [22]. This acquisition process can have an impact on the debt to equity ratio (Ibid). In their study, Modigliani and Miller demonstrated that the cost of capital that a company has, is independent on the total capital of the company. Not independent is the cost of debt depending on the debt to equity ratio.

Accounting based value investment ratios

After developing the theoretical base for the research, a collection of accounting based value investment metrics will be presented that will later be used as exogenous variables in order to explain the risk of the investment. The measures are divided into the two groups, risk metrics and profitability metrics. Both groups are important to look at when valuing a business. The criteria presented by Graham and also the updates of them through current research are meant for the risk-averse investor [23]. This study focuses only on accounting determined ratios is due to the reason that the risk that is implied in the stock price should be excluded. This is due to the fact that later the risk will be tested based on the beta factor which is connected to the market risk. Therefore, this research paper uses as selection criteria only those criteria's that are not connected to the share price since this could cause already correlation with the risk factor.

The first group contains metrics that are linked to the profitability of the company such as the return on equity ratio. This group of metrics reacts quickly on changes in earnings of the company. Rea defined this group of metrics as "reward". Since the metrics react quickly, they are more influenced by short term actions of the company then the metrics of the "risk" group.

The second group of value investment metrics is named by Rea as "risk". According to Rea, the risk metrics are much more important when it comes to choose stocks that will outperform the market in the future than the performance metrics of the other group. The metrics in this group do not change rapidly with changes in earnings like the once in the previous group. This metrics describe the financial situation of the company and financial "health" of the company. Research of Graham and Dodd as well as from Rea showed that these factors play a relative more important role then growth in earnings in order to lead to a profitable investment in the long run.

The following Table 1 will give the reader an overview of how to structure this updated metrics for value investing and gives an overview that will in the following analysis be used to test the hypothesizes as well as answering the research questions of this study.

The presentation of the endogenous and exogenous variables in this theory chapter lead to the question what interdependences are between certain ratios and whether they influence each other? The theoretical concepts about fundamental value investment metrics and ratios as well as their benchmarks used in this study were collected and have been connected with each other within the theory chapter by reviewing literature. The goal hereby was to see what current research has studied in connection to the research topic. The chosen concepts have been selected by reading scientific articles found in the data bases like *Google Scholar, Web of Science* and *Elsevier.* The keywords used to search such articles were: *metric, Graham, value, investment, ratio, valuation, KPI, risk, accounting* and *analysis*. All these keywords were used in a separate and conjoint way in order to get more results from the search.

Hypothesis development

Financial ratios that deal with the way a company is financed has all the same accounting related data as a base. Cola et al. showed in their research that the way a company is financed is linked to the size but also to the rating of the company and with that the perceived risk of failure. This can be seen in accordance to the theory of Jensen and Mecklingen [24] who stated that interest groups among the company can have different and congruent interests. The lender of debt wants to have a secure investment and if the risk of the company rises, the financing institution will ask for a higher interest rate in order to compensate the increased risk. Because of that fact, it need to be tested in this study whether the ratios that deal with the financing of the company have a correlation with each other and indicate the same for the investor. This would mean that these ratios give the investor a clear decision direction.

H1: Metrics that deal with the financial situation correlate with each other and indicate the same.

Research based on the principles of Benjamin Graham, used the principles from him to show whether the stocks that are selected by those, generate a value premium for the investors or not. For example, Oppenheimer & Schlarbaum [25] showed that an investor that uses these criteria to select stocks earns 3-3.5% more return than the overall market. This shows that the selection criteria presented by Graham need to indicate a clear decision direction for the investor. Most ratios for value investment selection deal with the profitability of the firm. An example for this is the return on equity or the volatility of earnings. Due to the reason that these profitability ratios are based on the same data sources they might indicate the same decision for the investor. This leads to the next hypothesis.

H2: Selection criteria that deal with the profitability will give the investor the same decision direction.

When focusing on both groups it needs to be looked on the connection between profitability and asset structure. The theory from Modigliani and Miller showed that the debt to equity ratio does not need to have a direct impact on the interest rates. This means that there is not a direct influence between the financial structure of a company

Group	Metric	Description	Benchmark	Influencing Scholar
Performance	Earnings Volatility	To explain the volatility of the earnings the Standard deviation in relation to the earnings of the actual period.	Less than 20% in the last 10 years	(Graham and Dodd)
				(Balik and Mehran)
	Earnings Growth	CAGR over last 10 years plus no more than two times a decline of more than 5% during this period.	Min. 7%	(Balik and Mehran)
				(Klerck and Maritz)
				(Singh and Kaur)
	Return on Equity	Earnings divided through equity	Min. 12%	(Graham and Dodd)
				(Basu)
	Cash Flow	Positive over 10 years	Min. 4% of turnover	(Bierig)
				(Oppenheime)
				(Graham and Dodd)
Risk	Size	Measured by the turnover of the company	$232-465 Mio.	(Graham and Dodd)
				(Balik and Mehran)
				(Colla et al.)
	Debt/NCAV	Total debt divided through the net current asset value (NCVA) (current assets minus current liabilities)	Bigger than 1	(Graham and Dodd)
				(Singh and Kaur)
	Debt/Total Assets	The ratio between debt and total assets	Lower than 30%	(Balik and Mehran)
				(Colla et al.)
				(Graham and Dodd)
	Long term Debt/WC	Long term debt in relation to working capital (current assets-current liabilities)	Max. 1	(Balik and Mehran)
				(Appuhami)
	Current Ratio	Current assets divided through short term liabilities	Min.1	(Graham and Dodd)
				(Appuhami)
	Margin of Safety	Earnings divided by interests and dividends	Min. 4	(Graham and Dodd)
				(Klarman)

Table 1: Fundamental accounting determined value investment metrics.

and the profitability. When combining both groups of fundamental financial ratios, they might not give the investor the same decision direction due to independences in the different ratios. This is due to the fact that companies with different financing structures might have different return on equities since the financing is not always a reason for the return on equity of the company. According to Fisher just focusing on selection criteria will give the investor not the complete picture and is because of that only the first step in valuing businesses. This leads to the following hypothesis.

H3: Both selection criteria groups can indicate contraire decisions.

A core concept in value investment is the margin of safety. Yee stated that the idea of value investment is to buy a company that has lower risk and therefore a better return in the long run. This is backed up by Patari & Leivo who wrote that through a lower price, the investor buys a value premium that can be reached in the future by the stock market price as well as the dividents. Therefore, it should be possible to find companies with a lower risk then the overall market. This also shows that the risk of a company cannot be fully implied in the price of the stock. This can hold true according to the information efficiency theory from Fama. A lower price compared to the value of the stock, reduces the investment risk of the investors since the likelyness for raising and with that closing the gap between the current stock price and the perceived value is high. This leads to the fourth hypothesis of this paper.

H4: Stocks that fulfill most of the value investment criteria have a lower risk compared to the overall market.

Method

Sample

Data was collected through the Finance information platform Fact Set. The risk was measured by using the leveraged beta reported in this data base. The required financial data was downloaded from the data base Fact Set to be able to answer the research questions and to test the hypotheses in this study; the method of analyzing is seen as fitting to the research purpose. The chosen method allows it to generalize and gives an overview on how methods are used in a variety of stocks.

Based on the literature review, the required data was defined that was needed to calculate the measures that will be tested in this research. Based on the definition of those, the relevant financial data was defined. By using the right Fact Set formula, the data was downloaded to Excel. In Excel the researcher cleaned the data so that only companies with a complete data set over the time window were used. Hereby it was important to understand which data will be really used in the calculation process in order to have the sample size as big as possible.

The metrics were calculated by using the formulas discussed in the theory chapter. All in all, 10 metrics were calculated. The calculation was done by using the spread sheet program Microsoft Excel. For every metric a new sheet was used so that the calculation process is clear and transparent. This was in particular necessary because some of the metrics require more data since they are based on a whole time series and or statistical operations like the analysis of the volatility in earnings.

After calculating the metrics, it was marked which of the metrics fulfills the benchmark which would define the stock as investment case. This step was necessary in order to perform some of the analysis steps which will be described in the following section of the method chapter. The detailed information on which data was used in order to calculate the metrics can be seen in the Table 2a under operationalization.

The following analysis will be based on the theoretical concepts and the selected metrics and will follow the in Figure 1 described process. The first step will look on whether this metrics have the same decision direction and give with that the investor a clear signal. The opposite could be that various metrics indicate different situations of the investment target which would result in a suboptimal base for the investment decision.

Group	Metric	Data measure	FDS Fact Set Function
Performance	Earnings Volatility	Earnings per stock	EPS
	Earnings Growth	Earnings per stock	EPS
	Return on Equity	Earnings p.a. and equity value	EA
	Cash Flow	Cash flow figure	CF
Risk	Turnover	Turnover	SA
	Debt/NCAV	Total debt, current asses, total liabilities	D, CA, TL
	Debt/Total Assets	Total debt, total assets	D, TA
	Long term Debt/WC	Long term debt, current assets, current liabilities	LTD, WC
	Current Ratio	Current assets, short term liabilities	CA, STD
	Margin of Safety	Earnings, interests, dividends	EAR, INT, DIV

Table 2a: List of collected data through Fact Set.

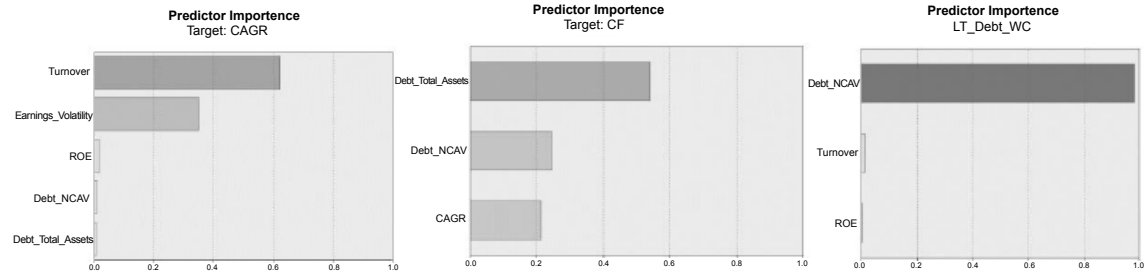

Figure 1: Main predictor's performance.

In the next step it will be focused on the criteria and whether companies who full fill more of the mentioned investment criteria have also a lower investment risk. The data sample is from 2002 to 2012. Some measures needed more data so that for them data was collected since 1996.

Analysis method

Statistical techniques: The first part of the analysis will use statistical techniques to examine whether the chosen metrics give the investor the same decision direction or not. The first method that is used is the correlation analysis which aims to measure the correlation between variables, for which, normality cannot be assumed. Furthermore, this method focuses on the relative difference between specific metrics and business groups. In this study, the correlation analysis was used to check whether there is a correlation between the decision directions that certain metrics give the investor.

The *correlation analysis* was used by creating a covariance correlation matrix between each of the ratios in the two groups risk and performance. The method was used in order to present the decision direction of the variable and to demonstrate whether they point in the same direction or not. Furthermore, the correlation matrix was used to test collinearity between the exogenous variables.

In order to get more insights in how use metrics, the technique of *regression analysis* was applied and beta factor became the dependent variable. This method was chosen to gain a deeper knowledge in order to analyze whether there is significance between an independent variable and the profitability. Thus, the beta value out of this analysis can give then additional information on how high is the impact: the higher the number, the higher the impact. Furthermore, the regression analysis in SPSS created an analysis of variance (ANOVA) that gave information regarding the significance by presenting the p-value for each regression test. With this information it was possible to evaluate whether the regression model is useful in order to predict the relationship between the independent variables and the dependent variable. Current research has shown that when applying all the value investment criteria to a stock, not a single stock would be chosen by this selection rules. In order to examine the principles of Graham and whether the decision rules would lead to a lower risk in investments, an effort has been made so that every rule individually as well as collectively was examined. Every company in the selected data set was examined for all of the selection rules. If the company meets a score benchmark, it was evaluated with a 1 and if not with a 0. This individual binary digit score was then further used in the analysis. All of these scores are then cumulated in order to calculate a composite score. If a company met four of the criteria then it got the score 4, if five then 5. The aggregate sum of the binary scores is the aggregate score [26].

After calculating the score for all the firms in the sample, the firms are divided into groups. For example, the groups of companies with the lowest score (0, 1) and the group of firms with the highest score (8, 9). In order to examine differences in risk, an independent *sample t-test* was used to analyze the data material. Furthermore, this test was also used to test firms mixed in groups with aggregates returns such as firms with the scores (0, 1, 2) and (7, 8, 9) and also (0, 1, 2, 3) and (6, 7, 8, 9). This will help to get to know whether firms with a high score differ significantly in their risk from lower score firms [27-30].

In the next step, it is examined whether the total score has a potential of explaining the variation over all risks. Because of the fact that the current data set includes both cross sectional units like companies and periodic observations of a set of variables which are characterized by the cross-sectional units), a panel data analysis was used to examine these issues.

The regression analysis which underlays the *panel data analysis* provides a means to control for missing variables in the data. In order to determine fixed effects in the data, a Chow test has been used. This tests shows the difference in coefficients across time and individuals. The insignificant p-value of the F-stats leads to the acceptance of the null hypothesis. For example, all coefficients over time and individuals are constant.

The presence of random effects has been estimated by using the Lagrange Multiplier test. This test works with a χ^2 distribution with one degree of freedom (df). However, because of the lack of fixed or random effects in the value makes the application of an ordinary lest square (OLS) regression possible, that assumes that all coefficients are constant over time and individuals [31].

Robustness check: Reliability research depends on whether the study can be reproduced and repeated several times. The method used for this study is quantitative, therefore it is crucial to think about reliability. Thus, in order to get high reliability, it is necessary that tools and techniques used to gather the data ensure the possibility of repeating the research. According to Bryman and Bell, a study can be considered reliable when future researches result into similar outcome using a comparable process. To ensure reliability a split test for the given sample was performed. The split test for both two halves of the sample gave equal results which makes this study reliable [32-35].

To get accurate information; only companies with a complete set of information's (ratios over the years) were targeted for this study. The companies needed to report a beta factor in order to quantify the risk of investment. The data was collected by using a professional data delivery service that is used in investment banking which ensures that the collected data is reliable. Afterwards, the collected data was elaborated in excel files and further with SPSS system in order to apply statistical analysis. The statistical tools used to analyze this study are presented in the heading before [36].

Validity is also important for the sake of the study and it can be achieved by having the collected data connected to theories. This was achieved by designing data collection process along the literature review. The cause and effect relation, on which this study is based, was tested by using the statistical software SPSS from IBM. This cause and effect relationships are according to Fisher a way to reflect internal validity [37].

Results and Analysis

Relations between ratios

The first part of the analysis is a correlation analysis between the value investment ratios. This analysis wants to look at the collinearity and the decision direction that the metrics give the investor. Based on the following table it can be seen that there is only a very low degree of correlation between the variables. The collinearity is also low. The two ratio group performance and risk are marked in the following Table 2b by a grey underlying color. It can be seen that between the ration within one group as well as across groups the correlation coefficients are low.

In order to visualize this and present possible connections between certain ratios in the two groups, a regression analysis was performed.

Correlations											
		Earnings Volatility	**CAGR**	**ROE**	**CF**	**Turnover**	**Debt NCAV**	**Debt/Total-Assets**	**LT-Debt/ WC**	**Current-Ratio**	**Safety-Margin**
Earnings Volatility	Pears on Correlation	1	.092**	-.001	0.001	-0.016	0.001	0.010	0.003	-0.004	-0.001
	Sig0. (2-tailed)	0.000	0.951	0.974	0.388	0.960	0.565	0.850	0.818	0.968	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
CAGR	Pears on Correlation	0.092**	1	0.042*	0.042*	0.195**	0.021	-0.004	0.046*	0.015	0.020
	Sig0. (2-tailed)	0.000	0.021	0.022	0.000	0.258	0.809	0.012	0.400	0.263	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
ROE	Pears on Correlation	-0.001	0.042*	1	0.000	0.019	0.000	-0.480**	0.001	-0.036*	0.001
	Sig0. (2-tailed)	0.951	0.021	0.990	0.288	0.984	0.000	0.964	0.047	0.938	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
CF	Pears on Correlation	0.001	0.042*	0.000	1	-0.051**	-0.009	-0.014	-0.003	0.003	0.001
	Sig0. (2-tailed)	0.974	0.022	0.990	0.005	0.601	0.455	0.857	0.869	0.974	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
Turnover	Pears on Correlation	-0.016	0.195**	0.019	-0.051**	1	0.016	0.018	0.010	0.054**	-0.005
	Sig0. (2-tailed)	0.388	0.000	0.288	0.005	0.378	0.329	0.589	0.003	0.786	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
Debt/NCAV	Pears on Correlation	0.001	0.021	0.000	-0.009	0.016	1	-0.006	0.670**	0.001	0.002
	Sig0. (2-tailed)	0.960	.258	0.984	0.601	0.378	0.729	00.000	0.946	0.896	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
Debt/Total_Assets	Pears on Correlation	0.010	-0.004	-0.480**	-0.014	0.018	-0.006	1	-0.007	.014	-0.004
	Sig0. (2-tailed)	0.565	0.809	0.000	0.455	0.329	0.729	0.693	0.453	0.839	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
LT-Debt/WC	Pears on Correlation	0.003	0.046*	0.001	-0.003	0.010	0.670**	-0.007	1	0.002	0.004
	Sig0. (2-tailed)	0.850	.012	0.964	0.857	0.589	00.000	0.693	0.934	0.840	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
Current-Ratio	Pears on Correlation	-0.004	0.015	-0.036*	0.003	0.054**	0.001	0.014	0.002	1	0.000
	Sig0. (2-tailed)	0.818	0.400	0.047	0.869	0.003	0.946	0.453	0.934	0.997	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035
Safety-Margin	Pears on Correlation	-0.001	0.020	0.001	0.001	-0.005	0.002	-0.004	0.004	0.000	1
	Sig0. (2-tailed)	0.968	0.263	0.938	0.974	0.786	0.896	0.839	0.840	0.997	
	N	3035	3035	3035	3035	3035	3035	3035	3035	3035	3035

Table 2b: Correlation table. **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

As the correlation analysis already showed, there are only very little correlations between some of the ratios.

In the group of performance metrics, the strongest correlation was given between the Cash Flow (CF) and the CAGR with 4.2% as well as the CAGR and the earnings volatility with 9.2%. When performing the atomized regression model in SPSS, the variable that predicts the CAGR the most is the Turnover followed by the Earnings Volatility. This can be seen in the following figure with the importance from 0 to 1. One means that the predictor ratio can explain the complete target [38-40].

As seen from Figure 1, the main predictor is from the risk group and not out of the performance metric group. When looking at the CF the main predictors for this variable are the following. It can also be seen here that the main predictors are not out of the performance group. Only the third (CAGR) is out of the same group as the target ration CF. And the prediction power is only half of the Debt/Total Asset ratio which holds responsible for more than 50% of the prediction. Furthermore, analysis of the prediction of the CF showed that the two debt related ratios have negative coefficients and the CAGR a positive. The direction of the ratios in which they need to be interpreted are therefore not equal. In accordance to this analysis steps it can be summarized that the hypothesis:

H2: Selection criteria that deal with the profitability will give the investor the same decision direction

need to be rejected. The metrics that deal with the profitability of the company neither indicate the same decision direction for the investor nor do they correlate with each other and get through that exchangeable. Instead each of the metrics from this group needs to be observed in order to give the investor all information.

When looking at the second group of metrics which deal with the risk of the company it can be said that the strongest correlation can be observed between LT-Debt/WC and Debt/NCAV with 67%. The second pair with a higher correlation than average is the Current-Ratio and the Turnover metric with 5.4%. Based on an atomized regression modeling it can be shown that the main influencing variable on the LT-Debt/WC metric is the Debt/NCAV. As shown in the following figure this metric has the highest predictor importance in the regression model [41,42].

Also in the following metric which is the Current Ratio, it can be seen in the Figure 2 that the main predictor of the value is the Turnover ratio which is also the one with the highest correlation. In this part of the analysis it can be seen that both the strongest correlation is given between metrics of the same group as well as the prediction importance of certain metrics in the regression model is given by metrics of the risk group. This leads to the conclusion that the hypothesis:

H1: Metrics that deal with the financial situation correlate with each other and indicate the same can be verified since the risk metrics have the biggest influence on each other.

However, the correlation is in all situation low. In both groups the correlation between the metrics was not high enough to use one metric in exchange to another. This leads to the next step of the analysis where the metrics of both groups will be analyzed in order to see relations between the two metric groups. In fact, the correlation analysis showed that the strongest correlation is between certain risk metrics and performance metrics. Between the Turnover and the CAGR the correlation is 20% and between the Debt/Total Assets and the ROE 48%. It can be seen in the figure above that the ratios with the biggest prediction power for the Turnover comes from the performance group. Also when looking at the Debt/Total Assets it can be seen that the major influence in the regression model is given by ratios from the performance group. This leads to the conclusion that in the regression model the predictor importance is the highest by ratios that are from another group than the ratio which will be predicted by the model. However, the low correlation between all variables showed that an exact prediction of the ratios by each other can't be done without a significant error. This leads to the conclusion that first the hypothesis H3:

H3: Both selection criteria groups can indicate contraire decisions can be confirmed.

Furthermore, the analysis showed that the ratios presented by current research are not correlated with each other and give therefore not redundant information to the investor. The theory form Modigliani and Miller explained that there is an interaction between the interest rate that a company needs to pay and the debt to equity ratio. This means that ratios of the two groups can be influenced in different ways. In combination with the outcome of this analysis it can therefore be stated that the selection criteria presented in this paper give the investor insight into the financial situation of the company by looking at the performance as well as the risk (e.g. Debt/Total Assets). All this presented criteria support the investor in his decision and give new information that add value to the analysis. None of the presented accounting based value investment metrics can be exchanged by another with giving after the exchange the same complete set of information to the investor.

The fact that the sum of all ratios give the investor a complete picture of the target investment and that every single ratio is important, leads to the next part of the analysis. Here the research will demonstrate whether stocks selected by the presented ratios will lead to a less risky investment then the overall market [16,43].

Contribution of metrics to select low risk investments

The statement of Rea that the value investment approach is for the conservative investor as well as the concept of the safety margin that Yee presented, leads to the question whether the selected stocks have a lower risk then the overall market.

This part of the analysis focus on how many of the criteria each company has met. Then the samples are grouped in different categories by looking at the total score of matched criteria for each year. The criteria that were used to group the companies can be seen in the Table 1 of this paper. For calculating the criteria, a period of 10 years from 2002 to 2012 were used since some of the criteria look at the development of certain financial values. Also only 13 companies fulfilled eight scores and no one more. Further the next Table 3 reports the independent samples that will be used to find a significance of differences in the risk of companies fulfilling a maximum or minimum of the rules for value investment stated by current research.

After looking on the distribution of matched scores of the sample companies it is important to analyze whether these companies that match most of the criteria have also a lower risk.

The following Table 4 shows the independent sample t-test results for the companies with a p-value of 0.05. The difference in the mean beta factors (10%) of the firms with high scores (8, 9) compared with firms with low scores (0, 1) is significant at 5% level of significance. Similar results were found when comparing companies with high score (7, 8, 9) and low score (0, 1, 2) companies which were significant at 5% significance. Also for the other two pairs (6, 7, 8, 9) and (0, 1, 2, 3) as well as (5, 6, 7, 8, 9) and (0, 1, 2, 3, 4) similar results were found for the beta factor. Those high-score firms mostly outperform the low-score firms with the risk and show a lower beta factor then the low-score firms. Only when looking at the pair (6, 7, 8, 9) and (0, 1, 2, 3) the low-score firms have a lower beta factor. This can be due to the fact that some of the companies might have negative beta factors

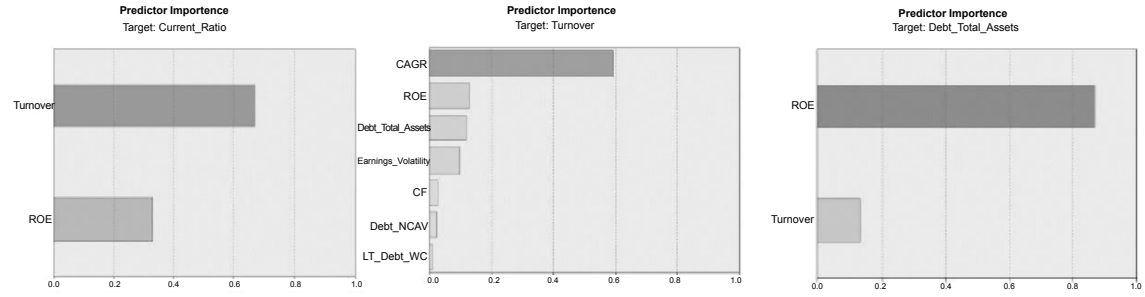

Figure 2: Main predictors risk.

which mean that the companies' stock price has a development in the opposite direction then the market. This results in the fact that when a company has a high negative beta it means that the price fluctuates much compared to the index but it will influence the mean in a way that the mean is lower. This would result in the interpretation that this group has a lower risk then the other one.

The F value in the Levene's test examines the variance of two groups of variable (here the low and the high score group). It is significant at a level of 5%. The overall t-test shows significant differences between the firms that fulfill a maximum of rules of the criteria for stock selection and the firms who fulfill a minimum of criteria. Table 5 further more shows how many criteria a stock need to fulfill in order to have a lower risk then the overall market.

It can be seen that from the companies on, that fulfill min. six of the criteria, the mean of the beta factors decrease. And it reaches the lowest in the group of companies who fulfill eight criteria which is the maximum number of fulfilled criteria in the sample.

The closer the score is to 0 the lower is the risk of the investment compared to the overall market. It is interesting to see that at the step from 0 fulfilled criteria to 1 fulfilled criterion, the risk decreases a lot from 4.08 in mean to a mean of 0.54. of the beta factor. This reduction in the beta factor can lead to the interpretation that already one of the rules for value investing helps investors to focus on the less risky companies. From one to five fulfilled criteria the average beta factor does not change significantly but from five to six it drops again and the next big change is from seven to eight criteria that are fulfilled by the stock. Finally, it can be said that a stock needs to fulfill at least six criteria for value investment to have a truly lower risk then the overall market.

The next step contains a pooled OLS regression analysis. This step has been performed in two ways. First the total score is used as independent variable and the beta factor as dependent variable. The second version was done by using all the single scores for the criteria as independent variable and the beta factor again as dependent variable (Table 6).

When looking at the R and especially at the R square it can be said that there is not a correlation between the Total Score and the beta factor.

In this case the Table 7 will be used to say whether the regression model is significant better as a predictor then a correlation analysis. Here, it can be seen that the Sig.-value is above 0.05 which means that the F value is so small that it is possible that it occurred by chance. We have therefore a low significance in this model.

When looking at the coefficients, reported in the Table 8 above, it can be said that there is a low positive relation between the total score and the beta. With a higher score, the beta increasers in average 0.01. In the standardized view, it increases 0.015 which is still very low and supports the analysis made in the model summary that there is not a high correlation between the total score and the beta factor which is demonstrated in the next figure that shows the plot of the regression line between total score and beta.

This leads to the next step of analysis. Since the total score and the beta as shown in Figure 3 is not in clear relationship to each other, the single score has a significant impact on the beta factor and can predict it. Therefore, a second pooled OLS regression was performed where the ten selection criteria act as independent variables and the beta again as dependent variable (Table 9).

The model summary shows a higher correlation (R of 0.224) then when using the total score as a predictor. However, the correlation is still low when looking at the R square which is 0.05.

The ANOVA Table 10 shows in this analysis step a high significance with a value of 0.000. Which means that the F value did not just occurred by chance.

The coefficient Table 11 shows the values that describe the influence of one of the single scores on the beta factor. The selection criteria

Year	No. of companies	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
		0	1	2	3	4	5	6	7	8	9	10
2005	872	238	19	133	169	138	115	41	16	3	0	0
2006	873	185	30	127	183	159	116	44	26	2	0	0
2007	874	117	43	132	198	178	127	60	16	1	0	0
2008	875	78	26	148	229	194	122	59	15	1	0	0
2009	876	40	30	153	257	188	131	58	13	2	0	0
2010	877	19	73	212	205	195	119	33	15	1	0	0
2011	878	8	82	229	198	181	112	49	13	0	0	0
2012	879	5	89	217	202	199	93	50	14	3	0	0

Table 3: Score wise distribution of sample companies.

Sl. No.		Mean beta	Z-value	F-value	Assumption of variance assumed
1	High (5, 6, 7, 8, 9)	-0.2457	0.497	0.000	No equal variance
	Low (0, 1, 2, 3, 4)	0.3928			
2	High (6, 7, 8, 9)	0.5869	0.500	0.000	No equal variance
	Low (0, 1, 2, 3)	0.4171			
3	High (7, 8, 9)	0.6973	0.500	0.000	No equal variance
	Low (0, 1, 2)	0.4341			
4	High (8, 9)	0.3109	0.500	0.059	No equal variance
	Low (0, 1)	0.4156			

Table 4: Independent sample t-test.

Total score	Beta	No.	Mean	SD
0	0.651	5	3.773	7.325
1	1.036	89	0.227	0.603
2	0.007	217	0.442	1.304
3	0.584	202	0.391	0.542
4	0.060	199	0.330	0.700
5	0.491	93	-0.836	13.108
6	0.680	50	0.549	0.354
7	0.962	14	0.780	0.410
8	0.704	3	0.311	0.278

Table 5: Beta factors by the companies in the different groups.

Earnings Volatility, CAGR, ROE, Debt/NCAV, Debt/Total Assets, LT Debt/WC and the Safety Margin have a negative impact on the beta factor ranging from -0.019 to -0.15. The criteria CF, Turnover and the Current Ratio have a positive influence on the beta ranging from 0.039 to 0.423. The table shows that most of the ratios influence the beta in a negative way when fulfilling the selection criteria. However, there is in average not a high significance. When looking at the hypothesis,

H4: Stocks that fulfill most of the value investment criteria have a lower risk compared to the overall market.

It has to be said that this hypothesis can be confirmed with limitations. The regression analysis showed a correlation between the selection criteria and the beta factor. However, this correlation was low and differs from criteria to criteria which can lead to the fact that when looking at the total score the correlation is not given anymore. This leads to the conclusion that all criteria need to be revisited by its own and cannot be seen in combination with each other. Another point is that it needs to be mentioned that the beta describes the systematic risk that is given by the market and the fluctuation in stock prices. The unsystematic risk that is dependent on the individual financial situation of the company and that can lead to bankruptcy is not covered by this analysis since it is difficult to quantify. This limits therefore the outcome of this analysis.

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.015	0.000	-0.001	1.027

Table 6: Model summary Total Score/Beta.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.195	1	0.195	0.185	0.667
Residual	9,16,526	869	1.055		
Total	9,16,721	870			

Table 7: ANOVA Total Score/Beta.

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Total	0.010	0.024	0.015	0.430	0.667
(Constant)	0.390	0.084		4.655	0.000

Table 8: Coefficients Total Score/Beta.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.224[a]	0.050	0.039	1.006

Table 9: Model summary Single Score/Beta.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45,859	10	4,586	4,529	0.000b
	Residual	8,70,862	860	1,013		
	Total	9,16,721	870			

Table 10: ANOVA Single Score/Beta.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Error	Beta	t	Sig.
1	(Constant)	0.558	0.106		5.249	0.000
	Earnings_Volat	-0.100	0.158	-0.022	-0.634	0.527
	CAGR	-0.019	0.155	-0.004	-0.121	0.903
	ROE	-0.117	0.080	-0.052	-10.467	0. 0.143
	CF	0.059	0.113	0.019	0.520	0.603
	Turnover	0.423	0.084	0.190	5.036	0.000
	Debt_NCAV	-0.107	0.129	-0.040	-0.829	0.407
	Debt_Total_As	-0.157	0.082	-0.076	-1.912	0.056
	LT_Debt_WC	-0.112	0.091	-0.049	-1.232	0.218
	Current_Ratio	0.039	0.095	0.018	0.412	0.681
	Safety_Margin	-0.108	0.074	-0.050	-1.468	0.142

Table 11: Coefficients Single Score/Beta.

Conclusions

Summary of key findings

This study aimed to investigate the usage of fundamental value investment ratios to select stocks. The initial literature review provides an overview of metrics that are, based on current research, the main metrics that can be used to select stocks followed by the idea of value investment. The selection criteria were divided into two groups. One sums up the ratios that describe the performance of a stock. The other sum up the risk of the stock. Literature showed that there are more ratios focusing on the risk than on the performance part. The literature review showed furthermore that criteria could differ in complexity. The cash flow need more input data since ten years need to be analyzed. Other criteria are just focused on one single year like the return on equity ratio which is therefore easier to calculate.

The analysis of the decision direction by using linear regression analysis showed that the profitability metrics do not give the investor the same decision direction. Here the metrics do not influence each other which mean that one metric cannot be explained by another. Therefore, it can be that the metrics indicate a different decision direction. A reason for this could be that profitability does not automatically lead to cash flow. Furthermore, leads this finding to the conclusion that especially in the profitability group of ratios all different ratios need to be watched in order to get a complete picture. In the risk metric group, the influence under each other is much bigger. Here metrics can be exchanged by each other and the investor gets a clear decision direction from them.

The fact that some of the metrics are necessary to get a complete picture leads to the next research question that asks whether the stocks

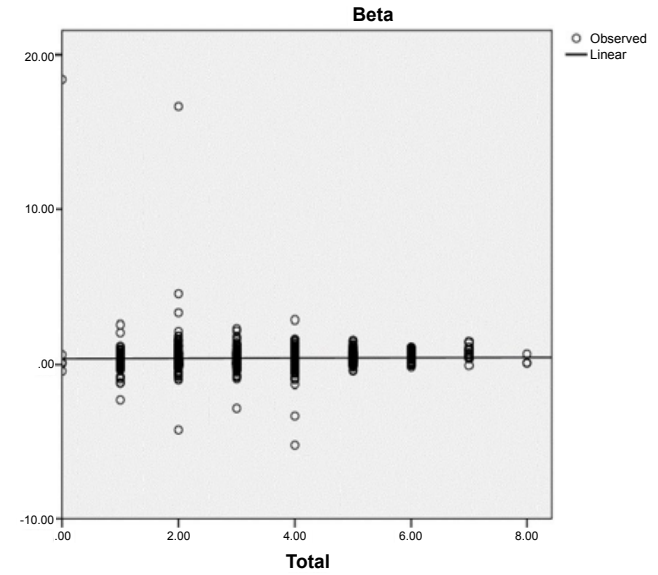

Figure 3: Plot Total Score/Beta.

that get selected from the above stated criteria have a lower risk then the overall market. Analyses showed first that only a small number of stocks fulfill many of the criteria. Further analysis showed that when looking only at the number of criteria that are fulfilled in total, the risk of the selected stocks is not lower at those that fulfill more criteria then other. However, when looking separate on the selection criteria it can be seen that a correlation between the fulfillment of selection criteria and a lower risk in form of the beta factor is given. This leads to the conclusion that stock selection criteria, needs to be revisited each other on a single base and not in combination with each other. The only number of criteria fulfillment indicates not automatically a low risk investment. At this point it has to be said that the outcome of this part needs to be limited since only the systematic risk was covered by the analysis.

Limitations

Endogenous variable risk might be limited in explaining the whole risk of a company since the beta is independent from bankruptcy cost. This factor limits the analysis of this paper because the individual risk of bankruptcy that each company has is not covered. A correlation between a lower unsystematic risk and with that risk of bankruptcy and the selection criteria is not covered and could lead to future research.

The fact that only few companies of the sample fulfill more selection criteria can lead to a low statistical significance when looking at these and when analysis the correlation of this group of companies and then beta factor. This could lead to future research questions and the necessary of new research project that update this analysis by using a bigger sample size or another time horizon where more selection criteria are fulfilled.

Future research

The study of investments and financial markets becomes more and more elaborate. However most of the research focuses nowadays on market data and not on fundamental investment criteria.

Since some investors e.g. Warren Buffett have a high success rate and outperform the market, a look on these investment principles could lead to a better understanding of this investment success. The future research that occurred out of the work on this project should focus on two main points that limit these paper and that could be solved by future projects.

The first is the fact that this paper quantifies the risk of each investment by looking on the systematic risk (market risk) which is described by the beta factor. This exclude all the risk factors that each individual company has and that can lead to bankruptcy also if the beta factor is 1 or below one. Future research could use another approach to quantify the risk and test the selection criteria against this new risk factor. This could lead to another result since the unsystematic risk can differ from the systematic risk that a company has.

The second point that limits the result of this study is the fact that only few companies of the sample fulfill more selection criteria. This can lead to a low statistical significance when looking at these and when analysis the correlation of this group of companies and the beta factor. Future research should therefore change the sample size and or change the research horizon in order to have another sample size where more companies fulfill more stock selection criteria. This would lead to a higher reliability when focusing on the group of companies with a high number of fulfilled criteria.

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