Msc in International Business

Department of Business Management

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Technical and fundamental analysis in the US Stock market

A comparison of value and momentum strategies in the S&P 500

Master Thesis

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Abbreviations

B/M – Book-to-Market (price) ratio

B/P – Book-to-Market (price) ratio

BCG Matrix – Boston Consulting Group Matrix

BE/ME - Book-to-Market (price) ratio

BE/P - Book-to-Market (price) ratio

BSM – Black-Scholes-Merton Model

C/P – Cashflow-Price-ratio

CAPM – Capital Asset Pricing Model

D/P – Dividend-Price-ratio

E/P – Earnings-Price ratio

EBITDA – Earnings before interest, taxes, depreciation and amortization

EMH – Efficient Market Hypothesis

EPS – Earnings per share

EBIT – Earnings before interest and taxes

EUT – Expected Utility Theory

FCFO – Free Cash Flow to Owner

GDP – Gross Domestic Product

IPO –Initial Public Offering

SMEs – Small and medium sized enterprises

LSE – London Stock Exchange7

Market Cap – Market Capitalization

MPT – Modern Portfolio Theory

MU –Monetary Units

NYSE – New York Stock Exchange

PESTLE – Political, Economic, Social, Technological, Legal, Environmental

RCT – Rational Choice Theory

RP – Risk Premium

SG – Sales Growth

SPX – S&P 500 Index

SWOT – Strength, Weakness, Opportunities, Threats

VRIO – Valuable, Rare, Imitability, Organization

Executive Summary

This research paper aims to determine which of the two classic investment paradigms, technical or fundamental analysis, generates the highest return for the investor. To identify adequate stock selection criteria for these two paradigms, the thesis starts with a thorough explanation of the theory of financial markets. The classic financial market theory assumes a high degree of efficiency in the stock market. The EMH assumes that investors behavior on an aggregated level is rational and therefore leads to correct prices[1]. These assumptions are questioned by the findings of behavioral finance[2]. The expansion of classical financial market theory to include aspects of behavioral psychology allows for new explanations of "investors´ behavior". The theory part of this work continues to introduce the reader to the core elements of behavioral finance theory. These elements indicate that individual financial market participants are using heuristics to process financial market information. From an institutional perspective, the agency factors described in this study allow for a better understanding of financial market (in)efficiency. The theory sections ends with the identification of stock selection criteria into investment strategies to operationalize the fundamental and technical analysis. In the analysis section, these stock selection criteria are applied to the S&P 500 for the time period 1996 – 2016. The results show that the stock selection criteria generate above market returns, with the value-portfolios overperforming the momentum strategies´ annual returns by approximately 2%.

However, when comparing the performance of the examined investment strategies to the reference studies by Fama and French (1998) and Jegadeesh and Titman (1993), they do not achieve such high returns. This indicates that the market efficiency in the US stock market has increased over the past decades.

Furthermore, the results allow for two more conclusions: The size effect (Banz 1981) prevails even among the 500 largest listed US corporations.

The alternative risk measure[3] applied to the portfolios indicates that the "margin of safety"[4] did not prevent investors from the impact of the financial crisis 2008/2009.

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[1] Markowitz, H. (1952)

[2] Kahneman, D., & Tversky, A. (1979)

[3] Chan and Lakonishok (2994)

[4] Graham and Dodd (1934)

1. Introduction

1.1 Background

For financial academic researchers the question of higher profitability and return has been present for more than a century. Starting with the Dow-Theory at the beginning of the 20th century, through the development of fundamental analysis during the middle of the last century to the consideration of the relatively new field of behavioral economics, many theories and practices have been established. These theories and practices are academically accepted, taught and practically used today. The theories and practices either claim to know how to generate above (market) average returns or they assess the underlying conditions and assumptions, or both. Undoubtedly, these methods and practices have their reasoning to exist, as investors trust stock traders, fund and wealth managers who invest their money following investment strategies deriving from these findings. Despite their practical use, however, in the academic world there is an ongoing discussion about the validity and meaningfulness of major theories like the Efficient Market Hypothesis (EMH) and the Capital Asset Pricing Model (CAPM). This makes sense as the macroeconomic environment and with it the underlying conditions and assumptions are exposed to constant change.
This is very likely to be true for various fields of academic research in different fields and disciplines of science. However, for an academic discipline it is rather unusual that mathematically driven, fact-based criteria such as return and profitability can be and are maximized today through two very different styles of investing choices: Technical and fundamental analysis. From an academic perspective, it is more intuitively to respect the process of fact-driven fundamental analysis than trying to explain why a technician can predict the future price development of a security better simply by drawing lines into the graph of the stock price development.

1.2 Motivation

Being a business student, the author was convinced that the fundamental analysis is superior in terms of risk-return according to such common performance measures as the CAPM to the technical analysis. This opinion is possibly is driven by the academic background. As a student, the author has attended a variety of lectures addressing different aspects of business and economics. These academic approaches rely on facts that are ascertained, structured, evaluated and used to develop and apply concepts, frameworks, strategies and solutions. These outputs can serve as input factors to a fundamental analysis valuation process in order to determine and evaluate the drivers of the value of a company. Among those aspects are the functioning of macroeconomic models and the modern monetary systems, fiscal and monetary policy and labor market economics, financial statement analysis as well as concepts, models and frameworks that help assess the business environment of a firm, its competitive position and competencies. This fact-based information is used for concepts and frameworks to analyze different aspects of a company, its industry and macroeconomic environment, e.g. Value Chain Analysis, Core Competencies, VRIO Framework, BCG Matrix, Business-, Industry- and Firm-Life-Cycle, SWOT- and PESTLE analysis. After studying for several years, it is hard to believe that a technician doesn´t need any of these tools but just the graph containing nothing more than the stock price development over time and information about trading volumes.

The seemingly superior performance of fundamental investing strategies pursued by the iconic investor Warren Buffet in the light of the 2008/2009 financial market crash endorsed the author’s opinion on the superiority of fundamental analysis to its counterpart.

One day the author read an article in a newspaper referring a research study[5] stating that the “technicians” beat the “fundamentals”. Suddenly doubt was born in the author´s mind. How is it possible that today, with fast developing technology, huge amounts of data available and a computerized financial sector this question still can´t be answered once and for all? The existing research that assesses the question of the superiority was published and mostly refers to time periods several decades ago. Since then, the continuing internationalization and globalization have changed the world economy significantly. The weight of the sectors in economies of industrial countries is shifting away from production to service and innovation orientated companies. In addition, since 2008/2009 until now, policymakers, political institutions and central banks kept inflation rates historically low to boost economic growth. These vast changes in economic structure and the currently practiced financial policies might

[5] Avramov et al. (2016)

have changed the investment and business environment to such an extent that the validity of past research is questionable.

1.3 Research Question and Process

The main research question of this work is:

"In the considered period (1996-2016), which investment paradigm generates higher return in the U.S. Stock Market S&P 500, the technical or fundamental?"

To answer this question, two acknowledged representative market price strategies are chosen and applied on historic stock market data. The fundamental analysis is represented by the growth portfolio approach of Fama and French[6]. Many researches and studies have confirmed the existence of the value premium of the evaluation model of Fama and French (1998). Therefore, this work will not try to identify the level of the value premium. It takes the existence of the value premium and the superiority of the value portfolio compared to the growth portfolio as given and will only set up the value portfolios. The technical analysis is represented by a momentum-strategy developed by Jegadeesh and Titman[7]. The approach of Jegadeesh and Titman is modified and will only set up the buy-portfolios.

1.4 Structure

First, in the theory part, a brief literature review states the prevailing academic opinion and discussion in the field and presents common strategies of the two paradigms.

Secondly, this work describes the theoretical foundation used to evaluate investments and profitability, explain market and market participants' behavior and compare the fundamental and technical approach.

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[6] Fama and French (1998)

[7] Jegadeesh and Titman (2001)

Third, the approach to operationalize the two investment paradigms in the time frame 1996-2016 is presented. Following each of the two investment paradigms, a stock portfolio is created which will be used as a proxy to calculate the returns of each paradigm.

Finally, in the conclusion the results of the foregone analysis are presented and discussed. Figure 1 shows the structure of the thesis.

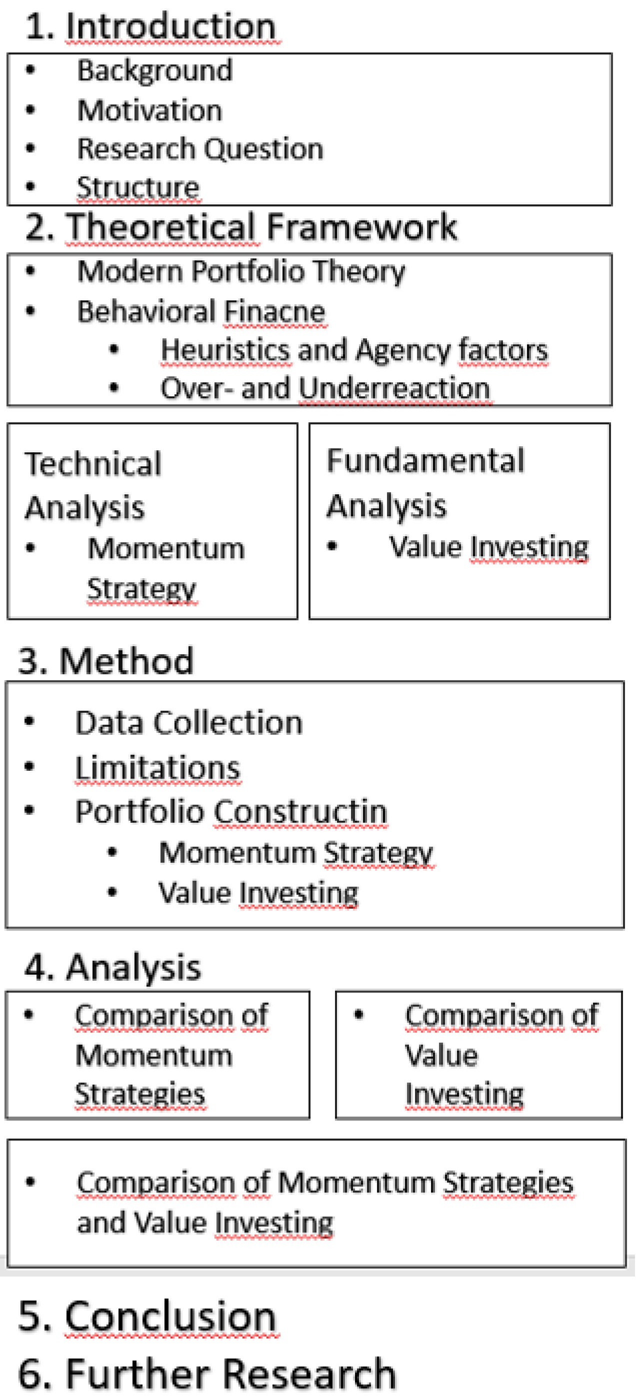

Figure 1: Structure of the thesis

2. Theoretical Framework

2.1 Literature Review

The current academic discussion about the models and theories relevant to this work is mainly driven by the validation, explanation and interdependency of results rather than finding new, undiscovered anomalies. Since the efficient market school reached its peak in the 1970s, until today it has lost some of that popularity through the discoveries of market anomalies and excess risk-adjusted returns in the 1980s. Since the 1990s, behavioral finance is more and more acclaimed and used by researchers in attempt to explain market anomalies. Behavioral economics modify the efficient market school´s models to account for psychological characteristics. Psychology influences judgment and preference of market participants' behavior and create what neoclassical models struggle to explain and label irrational behavior. By combining concepts of social and psychology sciences with economics and conducting experiments to gather empirical data, behavioral finance as a strong empirical link, especially when comparing with the efficient market school.

Excess returns have been the focus of extended research for many years. The two different schools of stock analysis, fundamental and technical, both were historically able to generate higher risk-adjusted returns than the market. Until today, academic studies have accepted the systematic existence of excess returns and try to explain rather than questioning them. In attempt to explain excess returns, many studies use models based on mathematical regression on historic data to determine what the drivers of stock prices are. These models are characterized through the chosen independent variables that try to explain the dependent variable, some sort of calculated return. The power of these models is determined by the time period of historic stock price data they are applied to as well as the amount of independent variables used. Increasing the amount of explanatory variables may increase the explanatory power of the model as a whole, but it becomes more difficult to refer their effect on the explained variable.

Technical and fundamental analysis started as two strongly opposing philosophies of stock selection. The technical analysis focuses on the historic development of a stock price and capitalizes in different ways on the trend behavior and its momentum. The fundamental analysis assesses no information content to the stock price and thus totally ignores the historic stock price development.

Despite the contrarian nature of the underlying philosophies, in both fundamental and technical analysis the concept of value investing generates higher returns (Fama and French 1998, DeBondt and Thaler 1985). The concept of value investing in those philosophies is based on different inputs. The fundamental analysis defines value as a relation of price and fundamental data, such as book value (B/P), earnings (E/P), and cash flows (C/P). The technical analysis looks at historic price developments to identify value stocks used in relative strength strategies.

Beginning in the late 1990s and early 2000s, researchers have combined explanatory variables of fundamental and technical models. The combination of formerly contradicting schools is called Fusion Analysis. Models of this relatively new academic field combine several factors of different nature in so called multi-factor-models with high explanatory power.

2.2 Modern Portfolio Theory

2.2.1 The Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) developed by Fama and Malkiel in 1970 is one of the most important theories for valuation and investment decision today as it is the first work of what later would be called the efficient market school[8]. The theory introduced a new perspective on the available information and its processing of capital market participants. According to the EMH a market is efficient when all relevant information is available to every participant and prices fully reflect this information at any given point in time. For financial markets, this means that information is free and rationally behaving investors always have access to all relevant existing information about a security, including insider information. On the basis of occurring events there is new relevant information that increases or decreases expected future cash flows, this information is immediately incorporated into the price of a security by investors. Regarding the processing of information, the EMH assumes that capital

[8] Montier (2010), p.21

market participants behave rationally and instantly respond to price anomalies. These price anomalies are exploited through arbitration, thereby generating profit, correcting the market price and preserving the efficiency of the market. The result of these assumptions is that it is impossible to develop an investment strategy that generates an abnormal return and beats the market in the long run since market prices always fully reflect the fundamental value of the underlying security or otherwise will quickly revert to it. The fundamental value is defined as the discounted sum of expected future cash flows. Given the EMH, the expected cash flows and discount rate are estimated correctly by investors. Therefore the EMH suggests investors to pursue a passive investment strategy and to buy and hold the market portfolio (Shleifer, 2000). Fama and Malkiel (1970) distinguish between three different forms of market efficiency: weak, semi-strong and strong. Depending on the characteristic of the efficiency of financial markets, the EMH assumes different ways in how past, private and public information is included in security prices.

Assuming weak information efficiency, current market prices reflect all information past prices enclose. Earning abnormal returns is impossible as past price movements such as trend or business cycles can´t predict price movements in the future. This makes the attempt to identify price movement patterns in historic data useless. This especially renders the technical analysis and technical trading strategies such as momentum strategies non-profitable, as future price and price movements are independent from past prices.

According to the semi-strong information efficiency, current market prices, in addition to past information of the weak level, include all public available information such as announcements of earnings and stock splits. This means that as soon as new relevant information is available, it is immediately anticipated by investors and included in the market price. Therefore earning abnormal returns by using fundamental analysis becomes impossible as well, as all available information contained in financial statements, market reports and announcements are incorporated in market prices.

Strong market efficiency means that security prices reflect all relevant information of the underlying asset. This implies that no investor has monopolistic access to price relevant information, hence no investor can consistently beat the market because of superior information gathering or processing skills rather than the randomness of luck and bad luck.

Given the assumptions and results of the EMH, it is obvious that the EMH is challenged by both technical and fundamental analysis. In addition, researches have addressed the fact that some investors are able to beat the market consistently. Out of this contradiction, in search for explanation, the field of behavioral finance has emerged. Relevant aspects of behavioral finance are discussed in section 2.2.3 (The Prospect Theory)

2.2.2 The Capital Asset Pricing Model, Modern Portfolio Theory and the Sharpe Ratio

The Capital Asset Pricing Model (CAPM) is another highly important pillar of modern finance theory and closely related to the EMH. It is an addition to the Modern Portfolio Theory (MPT)[9] developed by Sharpe[10], Lindtner[11] and Mossin on the basis of Markowitz work on portfolio theory[12] . The CAPM determines the price of an asset by putting the expected return of an asset in relation to its underlying risk. The CAPM has established itself to such an extent that the price of a security determined by the usage of this model is also referred to as the equilibrium price. In order to determine a price for an asset, the CAPM makes several assumptions about markets and market participants[13]:

- Investors are rationale, risk-averse individuals.
- All investors maximize the expected utility at the end of the investment period
- Investors have homogeneous expectations
- Investors are price takers. Investors don´t have market power, their transactions do not have an impact on market price
- Investors are diversified across a sufficient broad range of investments
- Investors can borrow and lend money to unlimited amounts at the risk-free rate

[9] Markowitz (1952)

[10] Sharpe (1964)

[11] Lindtner (1965)

[12] Markowitz (1959)

[13] Arnold (2008)

- There are no transaction or taxation costs
- Assets are divisible and liquid
- Relevant information about security prices are available at the same time to all investors (No Insider-Trading, strong market efficiency according to EMH)

The formula of the CAPM to determine the expected risk-adjusted return of an asset

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

Where:

$E[R_i]$: expected return of the asset
R_f : risk-free rate of return
β_i : beta-coefficient of the asset
$E[R_m]$: expected return of the market

The beta-coefficient is defined as:

$$\beta_i = \frac{\mathrm{Cov}(R_i, R_m)}{\mathrm{Var}(R_m)}$$

In words, the beta-coefficient is the sensitivity of the expected return of an asset to the expected return of the market and states to what extent the asset fluctuates when the market moves.

Given the assumptions mentioned above, investors prefer more to less return and vice versa regarding risk and every investor´s calculations about the expected return and risk of an asset or portfolio will have the same result. The investor´s expectation about the return of any given asset is only driven by its correlation with the market return, since the CAPM assumes that every investor has diversified to such an extent that the unsystematic risk of his portfolio is nonexistent. This leaves the investor only with the systematic (market) risk, calculated as the difference between the expected market return and the risk-free rate, multiplied with the beta-factor of the asset. Since the CAPM uses a market portfolio as reference, it assumes that it is impossible for investors to create a portfolio that outperforms the market portfolio in terms of the risk-adjusted return and that the market portfolio is mean variance efficient according to Markowitz[14].

[14] Markowitz (1959)

Apart from stock selection and portfolio creation by determining the risk-adjusted return profile of an asset, the CAPM is used for *ex ante* comparison and evaluation of a portfolio and its underlying investment strategy. The Sharpe-Ratio[15] is defined as:

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

Where

R_p: return of the portfolio
R_f : risk-free rate of return
σ_p : standard deviation of the portfolio

The Sharpe Ratio puts the realized excess return of a portfolio into relation with its risk and therefore tells an investor if the excess return generated is still superior to the market portfolio if its returns are adjusted for risk. In other words: “How much additional risk did the investor take to generate the excess returns? Is the risk-adjusted return still superior to the return of the market portfolio?” Scholars of the EMH argue that above-market risk-adjusted returns realized through trading and stock selection strategies also bear higher risk. The Sharpe-Ratio is one way to adjust returns for risk. The answer to these questions tells whether the portfolio has beaten the market regarding risk-adjusted returns and thus will be applied in the empirical studies of this thesis to compare the returns of the investment strategies chosen in 2.6.1 The Fundamental Model: Value Investing and 2.7.1 The Technical Model: Momentum Strategy. Additionally, alternative risk measures presented in section 2.6 The fundamental analysis will be used to adjust the returns generated by the two different stock selection strategies for risk.

2.2.3 Limitations of CAPM

Although widely accepted and used for a variety of purposes, there is criticism to the CAPM. Some criticism comes from the model itself. In order to use the CAPM, a proxy for the market has to be chosen, usually an index, as well as the time frame of historic data used to

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[15] Sharpe (1966)

calculate the beta. By choosing different proxies and calculating the beta on data of varying time frames, the results of the CAPM change. In addition, since the CAPM is using historic data as input, it is questionable if the circumstances and price movements of the past can unconditioned be upheld into the future. The main criticism, however, challenges the assumptions and methods of the CAPM.

First, the related theoretical framework of the EMH is challenged by behavioral finance, more specifically, by the Prospect Theory (see 2.3 Behavioral Finance).
Behavioral finance emerged as the efficient market school more and more was unable to explain empirical anomalies in stock markets. Through an approach that combines cognitive psychology, behavioral science and sociology with finance and economics, behavioral finance tries to explain the from the traditional finance point of view the irrational behavioral of individuals and on an aggregated level, of markets. Behavioral finance challenges not only the traditional economic theory but also its methodology. Where neoclassic theory develops assumptions of individuals and markets from a theoretical starting point, commonly in the field of behavioral finance theories are developed from an empirical starting point by conducting experiments with individuals simulating a market environment. By following such an approach, researchers take the experiment participant´s behavior as given and evaluate and analyze the observed behavior. Participants (money managers) make use of heuristics to derive an (investment-) decision when facing uncertainty and a lack of information, especially when there is only a limited amount of time to make a decision. Since heuristics are decision-making shortcuts, they imply that individuals are not always fully informed and therefore behave rationally, which contradicts neoclassical theories. Behavioral finance not always contradicts or rejects neoclassical theory. For instance, behavioral finance confirms risk-aversion of the individual. However, according to behavioral finance this risk-aversion is conditioned and influenced by the situation and past investment decisions rather than being steady and monotonic. Behavioral finance, more specifically 2.3.1 The Prospect Theory attributes decision making to the personal experience and history of the individual, which in an experiment with consecutive rounds have a major impact on decision making.

Secondly, like the EMH, the CAPM is questioned by practical disciples of the fundamental and technical analysis. See section 2.6 The fundamental analysis and 2.7: The Technical Analysis.

Third, the CAPM and EMH are academically challenged by researchers. According to research conducted by Fama and French (1992), Reinganum (1981) and Lakonishok and Shapiro (1986) the CAPM has no explanatory power in explaining stock returns in the period 1960 – 1990.
Specifically, Fama and French (1992) confirm the positive relation between beta and stock returns in the time period 1900 – 1969, but point out that leverage and the E/P-ratio provide better results. For the period 1963 – 1990, the authors do not find a relation between beta and stock returns, but size and the B/M-ratio do. Based on these findings on historic stock market data, Fama and French developed their 5-factor-model[16] in order to explain stock and bond returns.

Additional research studies found anomalies not in alignment with the CAPM and presented alternative models with different or additional variables, among others by Basu (1977), Banz (1981), Stattman (1980), Rosenberg et al (1985) and Bhandari (1988).

Furthermore, studies conducted by Chan and Lakonishok[17] confirmed the CAPM´s poor performance explaining the return of securities with low beta, which generate higher returns than the CAPM predicts. Additionally, the authors compared and reviewed their findings with other studies. The results are presented more detailed in section 2.6 The fundamental analysis.

2.2.4 Expected Utility Theory

The EMH and CAPM are two important pillars of traditional finance theory who aggregate individual investor behavior and thus addressing the market as a whole. The Expected Utility

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[16] Fama, French (1993)

[17] Chan and Lakonishok (2004)

Theory (EUT) investigates the behavioral characteristics of a single individual from the traditional finance point of view and can be seen as the counterpart to the Prospect Theory described in section 2.3 Behavioral Finance.

Behavioral finance emerged as the efficient market school more and more was unable to explain empirical anomalies in stock markets. Through an approach that combines cognitive psychology, behavioral science and sociology with finance and economics, behavioral finance tries to explain the from the traditional finance point of view the irrational behavioral of individuals and on an aggregated level, of markets. Behavioral finance challenges not only the traditional economic theory but also its methodology. Where neoclassic theory develops assumptions of individuals and markets from a theoretical starting point, commonly in the field of behavioral finance theories are developed from an empirical starting point by conducting experiments with individuals simulating a market environment. By following such an approach, researchers take the experiment participant´s behavior as given and evaluate and analyze the observed behavior. Participants (money managers) make use of heuristics to derive an (investment) decision when facing uncertainty and a lack of information, especially when there is only a limited amount of time to make a decision. Since heuristics are decision-making shortcuts, they imply that individuals are not always fully informed and therefore behave rationally, which contradicts neoclassical theories. Behavioral finance not always contradicts or rejects neoclassical theory. For instance, behavioral finance confirms risk-aversion of the individual. However, according to behavioral finance this risk-aversion is conditioned and influenced by the situation and past investment decisions rather than being steady and monotonic. Behavioral finance attributes decision making to the personal experience and history of the individual, which in an experiment with consecutive rounds have a major impact on decision making.

The Expected Utility Theory builds on the Rational Choice Theory[18], which assumes that individuals make decisions in order to maximize their utility score according to predefined preferences. Considering investments, according to the RCT, individuals make investment decisions whether to buy or sell stocks and portfolios in alignment with their personal risk preference. The EUT narrows individual behavior further down. Firstly it assumes that

[18] Coleman, Fararo (1992)

investors are risk averse. Secondly, utility is a solely function of wealth with a positive but diminishing marginal utility. Those two assumptions combined state that an investor always will favor a safe payment compared to an unsure payment that has the same expected value. This is totally in alignment with the CAPM, which aims at maximizing the return, or wealth and utility respectively, by minimizing the risk of the portfolio held deriving from the beta. Graphically, diminishing marginal utility and risk-aversion form a concave-shaped utility function as in Figure 2.

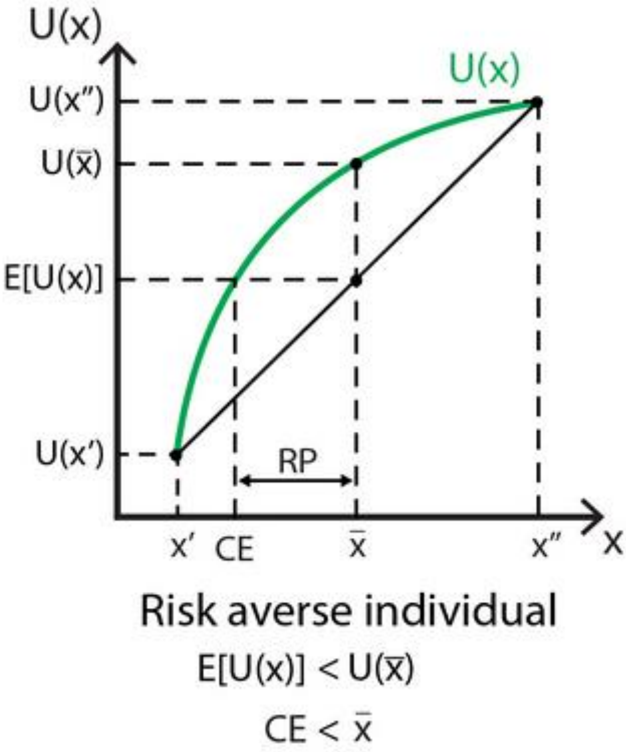

Figure 2: Expected Utility Theory: Risk-Aversion, Source: http://www.policonomics.com/lp-risk-and-uncertainty2-risk-aversion/

The neoclassical assumptions of the EUT are graphically shown in Figure 2. Here, the utility of a risk-averse individual of a lottery is shown. The situation can also be transferred into a situation of a risk-averse investor and an investment proposal offered to him. The lottery consists of two payments, x' and x'', each with a certain probability. These amounts weighted with their probability result in $\bar{x}$ with the utility value of $U(\bar{x})$. Due to risk aversion which shapes the concave utility function, the individuals expected utility of the lottery, E[U(x)], is lower than the utility value $U(\bar{x})$. The individual gives equal utility to a safe payment in the amount of CE, the certainty equivalent, as to the lottery, although the expected value of utility of the lottery is higher. The difference between the weighted probability $\bar{x}$ and the certainty equivalent is called the risk premium (RP). For a risk-neutral investor, E[U(x)] equals

$U(\bar{x})$, the CE equals $\bar{x}$ and the RP would be 0, respectively. This means that risk-averse investors relinquish return for safety. Instead of facing a return of an investment that bears risk, the investor prefers to reduce the return in exchange for a secure payment.

2.3 Behavioral Finance

Behavioral finance emerged as the efficient market school[19] more and more was unable to explain anomalies observed in stock markets. Through an approach that combines cognitive psychology, behavioral science and sociology with finance and economics, behavioral finance tries to explain the from the traditional finance point of view the irrational behavioral of individuals and on an aggregated level, of markets. Behavioral finance challenges not only the traditional economic theory but also its methodology. Where neoclassic theory develops assumptions of individuals and markets from a theoretical starting point, commonly in the field of behavioral finance theories are developed from an empirical starting point by conducting experiments with individuals simulating a market environment. By following such an approach, researchers take the experiment participant´s behavior as given and evaluate and analyze the observed behavior. Participants (money managers) make use of heuristics to derive an (investment) decision when facing uncertainty and a lack of information, especially when there is only a limited amount of time to make a decision. Since heuristics are decision-making shortcuts, they imply that individuals are not always fully informed and therefore behave rationally, which contradicts neoclassical theories. Behavioral finance not always contradicts or rejects neoclassical theory. For instance, behavioral finance confirms risk-aversion of the individual. However, according to behavioral finance this risk-aversion is conditioned and influenced by the situation and past investment decisions rather than being steady and monotonic. Behavioral finance attributes decision making to the personal experience and history of the individual, which in an experiment with consecutive rounds have a major impact on decision making.

2.3.1 The Prospect Theory

The Prospect Theory, developed by Kahneman and Tversky (1979), is one of the most important theories in the field of behavioral finance. Many other studies have been

[19] Montier (2010), p.21

published based or as addition to Prospect Theory. The Prospect Theory became acknowledged, because it is able to explain the behavior of individuals in situations where the Expected Utility Theory struggles severely. The Prospect Theory does not focus on the amount of wealth an individual has at the final stage of the experiment, or an investor at the end of the duration of his investment, respectively. Instead, the value function examines the perception of individuals or investors´ experiencing relative gains and losses through the time they hold the investment, rather than changes to the absolute amount of wealth at the end of the investment duration. By doing so, Kahneman and Tversky were able to prove that individuals perform mental accounting by integrating the outcomes of past investment decisions when assessing new prospects or investment decisions rather than segregating and evaluating each new investment opportunity independently from past investments made. The integration has a stronger effect when investors face negative returns, a fact implemented in Figure 3 by the initial steeper slope of the convex sector. The confirmation of mental accounting performed by individuals facing investment decisions is highly important for the evaluation of investments in general: It states that the perceived attractiveness of investments does not only derive from objective measures such as risk and return as the efficient market school and the CAPM assume, but also from the development of past investments of the individual investor. Following this argumentation, intuitively investors have different risk-preferences and are rather heterogeneous. Closely related to mental accounting is the “disposition effect” examined by Shefrin and Statman[20]. According to this effect, investors are eager to sell securities that experienced a price increase too early to realize gains, but due to the “loss aversion” effect hesitate to sell investments that generated losses. As a result, investors tend to sell profitable securities too early and hold on too long on unprofitable investment decisions.

Kahneman and Tversky conducted several experiments where participants had to choose from differing consecutive lotteries, called prospects. As an example, take an individual that is offered two prospects: One (A) with 80% change to gain 4000 MU and a 20% chance to gain nothing, the other (B) with a 100% chance to gain 3000 MU. Most experiment participants prefer (B) over (A).This is accordance to risk aversion also presented in the EUT,

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[20] Shefrin and Statman (1985)

because the expected value of (A) is 3200 MU, but individuals prefer certainty and put a higher weight to relative certain chances close to certainty. The over proportional weighting of certain outcomes is called the "certainty effect". If the experiment participants are to choose between a pair of prospects where option (C) is 80% chance to lose 4000 MU and a 20% chance to lose 0 MU and (D) a 100% chance to lose 3000 MU, most participants chose (C), although the expected loss from (C) is 3200 MU and therefore 200 MU higher. These results firstly contradict the EUT and secondly state that investors show risk-seeking behavior if the investment is loss-making and risk-averse behavior if the return of the investment is positive. Kahneman and Tversky name this anomaly the "reflection effect". According to the study, there is a difference of the impact of gains and losses on investor behavior, which gives the Prospect Theory's utility function a different shape: Concave for gains, convex for losses. According to the behavior of experiment participants who are offered a pair of prospects, (D) no prospect and (E) a 50% chance of either winning or losing 50 MU, most participants chose (D). Following this result, Kahneman and Tversky conclude that individuals perceive losses stronger than gains. Especially initial losses to individuals are very painful, even if the losses are relatively small[21]. They name this effect "loss aversion". The experiment setup using prospects enabled Kanheman and Tversky to slightly change the experiment and observe how these changes influenced decision making. Through changing the percentage rates, the amounts of gains and losses and taking into consideration the results and decisions of previous experiments the authors were able to test and confirm the results of the Prospect Theory in a variety of different simulated situations.

[21] Johnson, R. R. et al (2014)

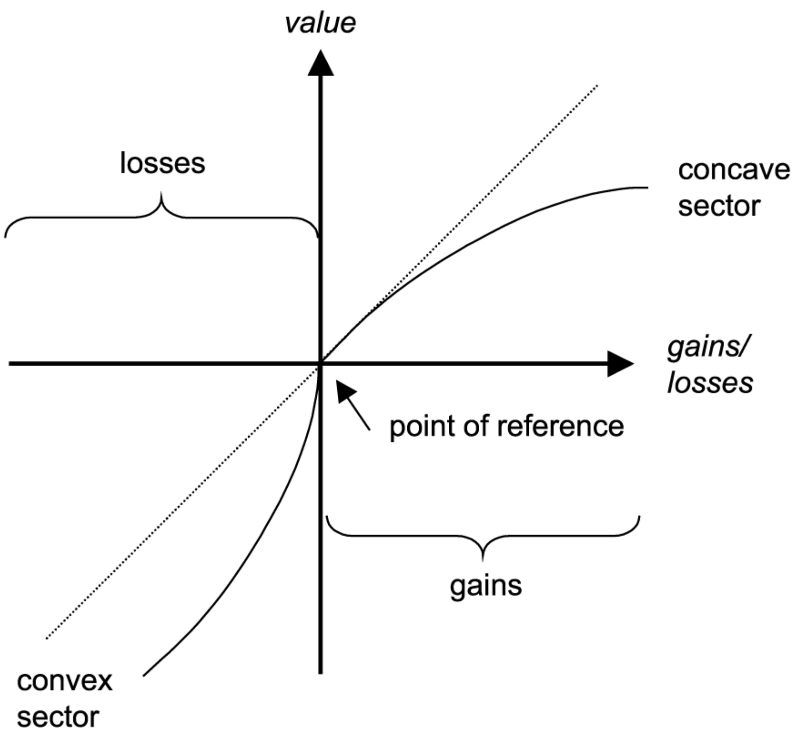

Figure 3: The value function of Prospect Theory. Source: http://4.bp.blogspot.com/-LuPWeGpTRUY/Td7yB-OGH1I/AAAAAAAAAkE/TYGKEOSdXAw/s1600/prospect+theory.png

In Figure 3 the "certainty effect", "reflection effect" and "loss aversion" are summarized in the value function of Prospect Theory. When assuming segregation the individual starts from the point of reference. However, if the individual is integrating the success or failure from previous investments, it is moving on the value function and thus the attitude towards risk is changing. The point of reference can be interpreted as the individuals starting point, in terms of investment decision, the investor's net worth. The fact the convex sector of the value function is steeper around the point of reference than the concave sector of the function is due to the "loss aversion". Due to the "reflection effect" the value function has different shapes in the positive and negative area. The Prospect Theory requires more specification of the environment when applied to an individual´s or investor´s decision making. Although it implies and analyzes various effects and therefore can be challenged, the Prospect Theory has some strong statements. According to Prospect Theory, investors perceive risk differently, depending from their very own context and previous developments of investments. Therefore, decision making can be irrational and not easily applicable on a large amount of presumably heterogeneous investors. Furthermore, preferences and perception of individuals can be influenced and are not steady as the EUT assumes.

2.3.2 Heuristics

Heuristics challenge the efficient market school by acknowledging that individuals who face complex situations of risk and uncertainty use rules and methods to simplify the decision making process. Through evolution the human species has developed heuristics to make decisions efficiently in cases of emergency where there is no time for a profound analysis. Participating in today´s financial markets requires individuals to process and interpret large amounts of information correctly, which might turn out to be extremely difficult or even impossible, especially in a limited amount of time. Limited by the capacity of the human brain, in some situations individuals are forced to use heuristics to reduce the amount of information processed at the cost of quality of the decision making process. When applied to financial markets, the use of heuristics helps market participants to lower the complexity of predicting returns and their probability of occurring. Heuristics work in opposite directions, for example representativeness and conservatism. At this time, behavioral science can´t fully determine the factors determining what heuristic individuals use in which kind of situation, but acknowledging the fact that these heuristics exist and influence the stock market is the first important step to explain stock market behavior.

2.3.2.1 Anchoring

Anchoring means that estimations made by individuals are based on a starting or initial value, which is altered or changed in the estimation process to develop a result. Thus, the starting point has a major impact on the final result of the estimation. The initial value can be influenced by personal experience, investment history or the frame: the scenario and the formulation of the question or problem. The possibility that the surrounding environment, external conditions and personal experiences influence the information processing and decision making of individuals challenges the EMH.

2.3.2.2 Conservatism

Similar to anchoring, conservatism addresses how individuals evaluate newly accessible information. Individuals give too little credit to new profound information that contradicts their present opinion. Applied on financial markets, this means that investors under react to information that indicate for example the reversal of a trend or the end of a growth phase while they overreact to new information that confirm their present opinion. The biased incorporation of new information leads to lagged market reaction and inadequate market prices. The fact that market prices do not response immediately to new information challenges one of the major assumptions of the EMH.

2.3.2.3 Representativeness

Representativeness occurs when there is no sufficient information available and individuals are facing uncertainty. Due to the lack of information, individuals tend to base their expectations about future events to the degree of similarity to recent and salient events and ignore statistical considerations and prior probabilities. In the scenario of financial markets, representativeness might cause investors to weight new information disproportionally high and as a result cause overreaction to new information, for example the recently strong development of an investment. Kahneman and Tversky (1974) identify two similar forms of biases caused by the ignorance towards statistical considerations and prior probabilities. The "base rate neglect" bias manifests when individuals prioritize their own perception to conclude the statistical characteristics of a population rather than use available information. The reason for this is that personal memories include emotional association and therefore the human brain gives more weight to these memories than to abstract and impersonal statistics[22] "Sample Size neglect" bias means that individuals tend to use a small sample size to conclude to the entire population, whereas a large sample size would be required. In both cases limited information, personally perceived or a statistical sample, is used as a basis to make a statement about a much larger amount of events or occurrences.

2.4. Agency Factors

The Prospect Theory attempts to explain market inefficiencies by assessing an individual's behavior in situations where different lotteries, or prospects, are offered. This aspect already covers a significant part of behavioral finance. To complete the picture of the efficiency and inefficiency of markets presented in this work, in this part aspects of institutional economics are presented. The cognitive biases of individuals attributed to the concepts already presented in this section are complemented by approaches focusing on how incentives and

[22] Johnson, R. R. et al (2014)

motives set by institutions and organizations influence an investors, analysts and managers behavior.

2.4.1 Dividend Policy

Agency factors derive from the institutional setting investment fund managers, analysts and managers operate in. A manager has to deal with various groups of stakeholders, among them his investors. To satisfy investors, companies and money managers try to keep dividend stable and cut them in financially distressful situations only as last resort. In the short term this might benefit the company as investors are not selling the stock, but in the long run this behavior seems rather irresponsible and possibly biases dividend-related performance figures, multiples and ratios. A company that is facing temporary distress requires all available funds to invest in new business or to modernize existing fields of business to boost future earnings potential. From the perspective of going concern, it is unfavorable to let these funds leave the company. Some managers even take additional debt to be able to keep the dividend payout constant.

2.4.2 Herding

Analysts are subject to herding effects. Generally speaking, growth stocks belong to companies of new, flourishing or booming industries and have a lot of media and analysts attention[23]. Today, digitalization, Big Data, the Internet of Things or Internet 4.0 lay the attention on Silicon Valley companies such as Facebook, Google and Apple. These companies currently notate at very high prices. As a result, money managers and analysts may have problems to justify buying or recommending stocks of less shiny companies that have performed poorly in the past when compared to the market[24] or growth stocks. Additionally, from a self-preserving perspective and through social pressure analysts and money managers have less reason to face personal consequences or sanctions when an investor suffers from losses with many other investors. These losses are perceived as systematic and unforeseeable[25] and money managers as well as analysts can take cover in their occupation

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[23] Bhushan (1989)

[24] Lakonishok et al. (1992)

[25] Koening (1999)

groups. As a result, growth stocks may be overpriced while value stocks are underpriced for the same reason.

2.4.3 Compensation

In order to align the interests of investors and money managers, a solution is to tie the money manager's compensation to the performance of the portfolio he bought on behalf of the investors. Instead, money managers are measured by the amount of funds they manage, also called assets under management (AUM)[26]. Funds charge a percentage of the amount clients leave with them. As long as clients have no reason to make a withdrawal, the money manager's compensation is guaranteed, regardless of the realized return on AUM for these clients. In order to increase compensation, money managers are motivated to focus on increasing AUM. This goal is achieved by risk mitigation through investment decisions in which money managers try to fulfill two requirements: Minimizing the risk measured by the CAPM and generating a return comparable to the benchmark, usually a leading stock market index or peer groups of other investment funds. Therefore, active managed funds end up creating a stock portfolio that mirrors the benchmark[27].

Next to fund managers, another group of money managers are traders, investment bankers and M&A advisors. Commonly the compensation for these representatives of Wall Street is a percentage provision fee for each trade. These provisions incentivize frequent trading regardless of returns. As a result, trading volumes at stock exchanges have drastically increased over the past decades, from one million shares per day on NYSE up to 1.5 billion shares per day in 2004[28].

2.5 Over- and Underreaction

The characteristics and traits described in the theory section of this work indicate that investor behavior is influenced by factors not considered by the efficient market school. Behavioral science puts the focus on information gathering and processing. By doing so it identifies a set of irrational patterns to describe and explain investor behavior through an interdisciplinary approach.

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[26] Kobayashi-Solomon (2015)

[27] Montier (2009)

[28] Graham (2005)

Following this argument, stock market prices are most likely not to mirror the adequate value of the listed companies but ought to be higher or lower, as the market price is the aggregation of individual market participant's opinion. This can enable investors to generate abnormal returns, which among other return measures can be calculated as the Sharpe-Ratio introduced in section 2.2.2 The Capital Asset Pricing Model, Modern Portfolio Theory and the Sharpe. The strategies applied in Section 3. Method both rely on market participants' irrational behavior, which manifests itself as over- and under reaction to new information and as a consequence incorrect market prices, to earn abnormal returns. The nature of information that investors react to has to be stock price relevant. To influence the stock price, it is required that the news contain some sort of information that market participants consider relevant to the future profitability of a certain company, sector or economy as a whole. Company related announcements typically contain information about realized or expected accounting figures related to revenues, earnings and costs. These figures can be influenced by developments on a micro- and macroeconomic level. Microeconomic news related to a single company among others are the carve-out of a business unit, an IPO, a merger and acquisition, strategic corporations, the expansion of the business into new markets, the acquisition of new customers or the release of new products. Moving to a more macroeconomic level, sector-specific news such as political subsidies or news regarding the whole economy, such as inflation-, GDP- and employment figures impact stock prices.

If an investor calculates the fundamental value of a company by himself, independently from the stock market price, he can capitalize on the difference of the investor´s best estimate and the stock market price. The fundamental approach is based on the observation that market participants extrapolate recent past performance of and information about a stock in a short- to medium term too far into the future while disrespecting fundamental long-term factors of the business[29]. This behavior is driven by overreaction of investors to unexpected price relevant information through the heuristics representativeness and conservatism[30].

[29] Lakonishok and Schleifer (2004)

[30] Barberis et al (1997)

The fundamental model capitalizes on the long-term price reversal as correction of the initial overreaction: In the long run the stock price will move towards the fundamental value of a company[31]. This pattern was observed in 18 OECD countries in a time period from 1900 until 2009[32].

The strategy representing the fundamental analysis in this work, value investing, assumes that the so called value and glamour stocks in the stock market are under and- overpriced, respectively, and thus don´t represent the fundamental value of the company.

In order to realize value investing strategies, the investor has to be immune or at least less vulnerable to irrational behavior as the majority of investors, since investing in value-stocks contains a contrarian element to the prevailing opinion of markets: "His role is not that of a prophet but of a businessman seizing clearly evident investment opportunities. He is not trying to be smarter than his fellow investors but simply trying to be less irrational than the mass of speculators who insist on buying after the market advances and selling after it goes down"[33]. Rational behavior requisites investor´s trust in his analysis of the fundamental value of an investment objective while other investors hold a different, prevailing opinion: "A sound mental approach toward stock fluctuations is the touchstone of all successful investment under present-day conditions"[34]. Graham impersonates the irrational day-to-day behavior in the shape of Mr. Market, a manic-depressive advisor that is susceptible to the latest news and stock fluctuations. As a result, Mr. Market´s opinion about the value of a business is inconsistent. Together with his recommendation to either buy or sell stocks it alternates on a daily basis. Graham urges investors not to surrender to Mr. Market´s opinion but to take him as an example of irrational market behavior that an intelligent investor is immune to.

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[31] De Bondt and Thaler (1985)

[32] Spierdijk et al (2012)

[33] Graham (2005), p. 31

[34] Graham (2005),p. 21

By following a contrarian investment strategy, investors can capitalize on the irrational behavior of the majority of market participants. Scholars have accepted the existence of the value premium, but argue about the reason of its existence. In an attempt to align the value premium with the CAPM, followers of the efficient market school argue with a higher underlying risk associated with value stocks[35]. This opinion is refuted by the work of Lakonishok et al (1994) and Chan and Lakonishok (2004), who find that neither the classic risk-measures such as variance and the CAPM´s beta nor the value stock performance in general economic unfavorable times conclude that value stocks bear a higher risk than glamour stocks. Instead, the authors present reasons from the field of behavioral finance and institutional economics previously explained in this work. The heuristics described in 2.3.2 Heuristics give a behavioral finance approach to explain the existence of the value premium through investor's overreaction.

Strategies deriving from technical analysis use the development of the stock market price and do not evaluate the underlying companies itself. Momentum strategies capitalize on the intermediate effect stating that for a certain time period, the trend of stock prices will continue as investors under react to new information. The heuristics representativeness[36], conservatism[37] and anchoring in the short to medium term drive under reaction, which ultimately leads to price momentum. Unlike value investing strategies, investors do not intend to capitalize on the absolute performance of stocks in comparison to other stocks of the market, but on the idea that once identified an existing trend will prevail in the future. Momentum strategies focus on the relative price performance to past prices in form of trends.

2.6 The fundamental analysis

Although it is very likely that single investors have made use of and practiced few or more elements of fundamental analysis for stock selection, the first codification was made by

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[35] Fama, French (1992)

[36] De Bondt and Thaler (1985)

[37] Barberis et al (1997)

Graham and Dodd in 1934 with the textbook “Security Analysis”. They did so as it was their opinion that in the aftermath of Black Tuesday the investors´ unsubstantiated behavior was firstly worsening the economic crisis and secondly opened chances to realize high returns. As the authors were unable to find any teaching material for students at Colombia Business School suiting their ideas about stock markets and investor behavior, they decided to write a textbook on their own. In this book, Graham and Dodd developed the intellectual framework on which Graham in 1949 in his book “The intelligent Investor” will base his concept of value investing.
The underlying assumption of the concept of “Security analysis” is that depending on their characteristics, next to stocks and bonds, investment objects in general can be categorized as investment or speculation. This categorization is based on an application of a combination of three different kinds of factors: market factors, future value or qualitative factors and intrinsic value or quantitative factors. The speculative approach focuses on market factors, supplemented by future value factors while the investment approach focuses on intrinsic value factors, supplemented by future value factors. Graham and Dodd suggest an investor to focus on the quantitative factors for two reasons. First, these factors are easily obtained as they are published in a standardized manner in annual reports and secondly contain much information as they address the company’s capitalization, earnings and dividends, assets and liabilities and operating statistics. These items are also influenced by qualitative factors like the nature of the business, the competitive position of the company in the industry, operating and management characteristics. Therefore, the study of qualitative factors might not be rewarded with additional information about the future performance of the company. The differentiation of speculative, quantitative and qualitative valuation methods is not absolute: In between speculative and quantitative approaches lay qualitative measures shown in Figure 4.
The application of fundamental techniques mentioned in 1.2 Motivation in the context of Graham and Dodd´s investment approach ultimately lead the investor to calculate the intrinsic value of a company. This is the value justified by a thorough analysis of available data.

As the rules of the investment approach strongly contradict the idea of Markowitz modern portfolio theory and legitimacy of related concepts as the CAPM, speculation also doubts the correctness of market prices. The difference is that while the investment approach attempts to derive an intrinsic value independently from market prices, the speculative approach capitalizes on the fact that market prices are not solely driven by fundamental value factors but also from individual psychology aggregated in the context of financial markets. To this extent, what Graham and Dodd label speculative approach has similarities to concepts of the technical analysis (see 2.7: The Technical Analysis). The main point of Graham´s and Dodd´s criticism is the idea of the CAPM´s beta factor where risk derives from the biased historic volatility of stock prices. In their opinion, security is defined as the “margin of safety”. A core concept, which describes the difference between the market price and the intrinsic value of a stock caused by market participant´s biased attitude. Following the risk concept of the “margin of safety”, the contradiction to CAPM´s beta becomes obvious when thinking about a stock that has lost significant value: Both, the CAPM`s beta and the “margin of safety” would increase. While an increase in the beta means a higher risk related to the purchase of the stock, a higher “margin of safety” could mean the opposite. Calculating the “margin of safety” by comparing intrinsic value and market price ultimately lead an investor to select stocks and securities temporarily trading at low premiums. Graham and Dodd consider this kind of stock selection an investment.

In “The intelligent Investor” is Grahams more practical guide to his investment approach and less of a textbook for scholars. Graham presents an active and passive strategy to apply value investing to match individual risk appetite. He recommends the layman to pursue the passive strategy by forming a simple portfolio consisting of US-Government and high rated corporate bonds and a diversified set of blue-chip stocks. With little effort and expertise and a long investment horizon the “Defensive Investor” safely can generate average market returns through the long-term increase in value. By recommending a diversified set of stocks Graham introduced diversification as the second core concept of value investing. MPT has not been developed yet. The prevailing opinion of financial markets and Wall Street was that investors should focus their attention on the analysis of a small number of investment objects

The active approach requires more expertise, effort and contains four strategies. Therefore, Graham recommends this strategy to investment professionals he calls the “Enterprising

Investor". The main difference to the "Defensive Investor" is the fact that investment professionals do not invest personal savings dedicated to their own pensions but fulfill a mandate primarily for clients with above average wealth. These clients can absorb higher risks as their wealth is distributed among various asset classes. Larger temporarily losses in the stock-portfolio are no incremental threat to their existence and financial well-being. The active approach requires knowledge about the principles of "margin of safety", intrinsic value and the skills for their determination. Two of the four strategies, *Formula Timing* and the *Growth-Stock Approach* Graham labels as speculative in the context of the intellectual framework of "Security Analysis". *Special Situations* include unusual occurrences such as M&A, recapitalization and liquidations. These investment-related processes require "a somewhat unusual mentality and equipment, [and in which] only a small percentage of [even] enterprising investors [should] engage"[38]. *Bargain Issues* typifies value investing and targets stocks and securities trading at a market price significantly below their intrinsic value. Since Graham considered market declines as symptomatically overreacting, in his opinion "the group as a whole offers an especially rewarding invitation to careful and courageous analysis"[39]. Graham´s description of *Bargain Issues*-strategy is the origin of today´s value-investing and the basis for the fundamental model described in section 2.6.1 The Fundamental Model: Value Investing.

Across value investing literature, the irrational behavior of market participants is an argument against the EMH-concept of risk and the usage of market prices as input for the evaluation process not only for stocks but for other financial products, such as options, as well.

Based on the work of Graham and Dodd, many researchers have contributed to fundamental analysis. Bettman et al (2009) give an all encompassing overview of academically acclaimed and practically used additions to the work of Graham and Dodd over time. Therefore, the author of this work refers to the first chapter of Bettman et al (2009) as further reading, if the reader´s interest exceeds the information presented in this work.

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[38] Graham (2009), p.175

[39] Graham (2005), p.103

Kobayashi-Solomon[40] applies the concept of the fundamental analysis to options, more precisely to the Nobel-Prize winning Black-Scholes-Model that today is most accepted and widely used model to price standardized options. The main point of Kobayashi-Solomon´s criticism on the application of the BSM model is the implied volatility. The value of an option is driven by the forward volatility of the underlying stock. Rather than applying a method similar to the fundamental analysis to obtain a fact-based, rationally driven forecast about forward volatility, the BSM-Model uses the current market price of an option as input to conclude the market´s expectation about the future volatility. As a result, the option prices deriving from the BSM-Model require the assumption of the EMH to hold. As market prices of stocks, the market prices of options are possibly driven by irrational behavior of market participants and therefore might be incorrect due to the factors mentioned in section 2.3.2 Heuristics, especially anchoring[41].

Followers of the fundamental analysis address the flaws of the beta-concept. They generate profits on the incorrectness of stock market prices mentioned above by evaluating the intrinsic value and capitalizing on this insight by investing or shorting stocks. By doing so, many authors and scholars use alternative risk measures which do not rely on historic market price volatility as the CAPM´s beta and the standard deviation of returns. Lakonishok et al (1994) follow an approach that compares the performance of value stocks and growth stocks in economically unfavorable times of a sample period. They use two methods to define and identify economically unfavorable times: Months of the sample period with severe stock market declines reported or generally economic recessions, measured as decline in GDP. Their statement is confirmed by Montier[42], whose empirical results show that in the worst 10 months of the stock market in 1950-2007 where the stock market reported a loss of 13% per month and growth stocks 18% per month, value stocks only reported a decline of 13% per month. Another concept is permanent capital loss, which is especially suitable for long-term investment strategies, as temporary capital losses caused

[40] Kobayashi-Solomon (2015)

[41] Kobayashi-Solomon (2015), p. 60

[42] Montier (2009)

by business cycles or high market volatility become more and more irrelevant as the investment period grows. (Graham, Montier?).

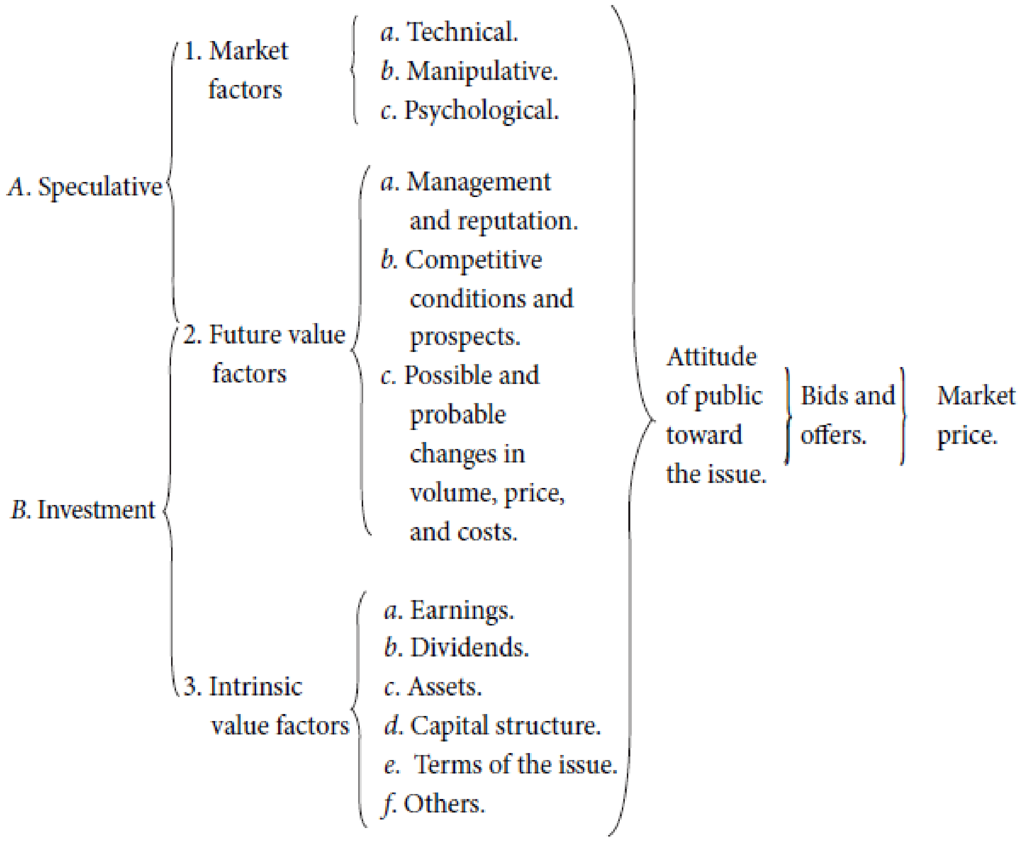

Figure 4: RELATIONSHIP OF INTRINSIC VALUE FACTORS TO MARKET PRICE, Graham and Dodd (1934), p. 29

Since the initial publication of "Security Analysis" and "The intelligent Investor" much time has passed and the concept of value investing has been accepted by a broad audience. This means that the concept of value investing changed the attitude of the public and effectively reduced the return potential as a wide mass of investors pursues such a strategy. In an interview conducted in 1976, more than 40 years after the initial publication of "Security Analysis" Graham[43] himself expressed his doubt that the evaluation process of his work still rewards investors with above-market returns.

- Criticies EMH and CAPM on practical and academic level. Explain more detailed limitations
- Criticism EMH->Mr.Mood
- Criticism CAPM-> changing price means risk

[43] Graham (1976)

2.6.1 The Fundamental Model: Value Investing

The fundamental analysis in the narrower sense is a forward-bound qualitative analysis approach of stocks. The model used in this work representing the strategy of value investing as a representative of the fundamental analysis is a contrarian strategy which follows a quantitative approach applied on historic stock market data in the time period 1996-2016.

In their pioneering work Fama and French developed their acclaimed two-factor-model which explains stock returns better then the dominating CAPM. A combination of company size and B/E-ratio provides the highest explanatory power in their sample[44]. Among the examined factors in these studies are B/M-ratio and E/P-ratio. Next to these ratios, Fama and French (1998) use the cash related ratios C/P and D/P to sort stocks and form univariate portfolios in order to identify value premiums in different stock markets.

The model is an academically important cornerstone in establishing a link between fundamental factors and returns and a step towards the market price strategy applied in the analysis section of this work. Since then many scholars, among them Chan et al (1991), Lakonishok et al (1994), Fama and French (1996) and Fama and French (1998) have expedited and widened the research on the return and risk of different portfolios commonly formed on Book-to-Market ratio (B/M), Earnings-Price ratio (E/P) and Dividend-price ratio (D/P) of stocks. The results are almost unanimously over time for major stock markets. Portfolios with high ratios and low premiums, called value-portfolios, generate higher risk-adjusted returns calculated with the Sharpe-Ratio than their counterpart portfolios consisting of stocks trading at high premiums and low ratios, called growth- or glamour-portfolios. "Based on the accumulated weight of the evidence from studies on the book-to-market effect and related anomalies, the academic community has generally come to agree that value investment strategies, on average, outperform growth investment strategies."[45] The outperformance of value-stocks to growth stocks is referred to as value-premium. High ratios indicate that the market´s expectation about future company performance is pessimistic. Therefore, the stock of the company is offered at a relatively cheap price given

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[44] Fama and French (1992), p. 428

[45] Chan and Lakonishok, (2004), p.71

its fundamental data. Stocks trading at a price indicate that the market expects the company´s fundamentals, such as revenue, earnings and cash-flow, to grow it in the future. Through discounting models, these positive future expectations are incorporated in the current stock market price.

In section 3.3 Portfolio construction of this work stocks will be sorted and univariate value-portfolios will be formed on the basis of the ratios used by Fama and French (1998). The author refers to the detailed list compiled by Chirkova[46] for further evidence of superior performance of value-portfolios compared to growth-portfolios. An excerpt of Chirkova´s findings is presented in Table 1.

[46] Chirkova (2015), p290-293

Paper	Ratios	Years	Markets	Value Premium p.a.
Basu 1977	P/E	1957-1971	NYSE	6,49%
Levis 1989	P/E	1961-1985	LSE	7,06%
Levis 1989b	D/P	1955-1988	LSE	5,50%
Keppler 1991b	D/P	1969-1989	Indices in 18 Countries	8,80%
Capaul et al 1993	B/M	1981-1992	France, Germany, Switzerland, UK, Japan, USA	2,44% (GER, FR, CH, UK) 4,70% (Japan) 1,27% (USA)
Lakonishok et al 1994	B/P E/P D/P	1968-1990	NYSE, AMEX	10,50% (B/P) 7,60% (E/P) 11,00% (D/P)
Chan et al 1995	B/P	1963-1991	Large Cap NYSE, AMEX	5,00%
Caj 1997	P/B D/P E/P SG	1971-1993	Tokio Stock Exchange	6,00% - 12,00&
Gregory et al 2001	P/B D/P E/P	1975-1998	LSE	1,2,53%
Lakonishok et al 2004	B/P E/P D/P	1969-2001	Large Cap NYSE, AMEX	11,90%

Table 1: Excerpt from: Research, examining investment strategies into value and glamour stocks. Source: Chirkova 2015, p.290ff

The validity of the value-portfolio approach to a high degree is given by the application of three academically approved and practically applied ratios. To further improve the validity, possible biases for each of the ratios are mentioned and explained.

2.6.1.1 E/P:

The E/P ratio is one of the preferred ratios by practitioners. It is follows an intuitive approach: How many years does it take for the investment to earn its purchase price? How much does an investor pay for one unit of net income? This concept is subject to the thoughts of many people who for example consider to purchasing real estate. After how many years renting out the property is the purchase price earned? This question addresses the profitability of a business or real estate, respectively. Furthermore, accounting standards in major economic regions to a certain degree are aligned. Rules and regulations are relatively strict, compared for example to the book value of assets. As the strongest arguments from an academic perspective, the E/P-ratio derives from the Gordon-Growth-Model[47] and is driven by earnings power, a value driver Graham[48] was very fond of.

2.6.1.2 B/P:

Historically, the B/P ratio, commonly named Book-to-Market or B/M ratio, is the most extensively used ratio upon evaluating the equity of companies and stocks in academic studies[49]. For listed companies, the ratio can be applied in the form of book value of the firm divided by the market capitalization or the book value per share divided by the stock price. Next to market value of equity as factor to account for company size, the B/M ratio is a factor Fama and French added to the CAPM model to derive their three-factor-model[50]. Upon followers of the fundamental analysis, the B/M-ratio serves as an indicator whether a stock is trading at a high or low premium and thus can be categorized as value or growth stock. This is due to the fact that the B/M-ratio puts the liquidation value of assets minus the accounting value of debt in relation to the market price. In addition, the B/M-ratio considers the leverage as it´s calculation involves the amount of debt. Additionally, Fama and French "confirm that, as predicted by simple rational-pricing models, BE/ME is related to persistent properties of earnings"[51] of the underlying stock. For further evaluation of a stock, especially from the perspective of an investor assuming going concern, the B/M-ratio is less suited. Rules and regulation of accounting methods vary across countries and regions and for some types of assets. For intangibles, companies have room for interpretation regarding how to determine the book value while the value of the workforce is ignored in the balance sheet[52].

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[47] Gordon (1959)

[48] Graham (2005)

[49] Chan and Lakonishok (2004)

[50] Fama and French (1992)

[51] Fama and French (1995), p.131

[52] Johnson, R. R. et al (2014)

To assess the intrinsic value of a company, fundamental analysts prefer ratios using earnings or earnings related accountant figures to the price.

2.6.1.3 C/P:

The dividend-yield ratio, as the D/P ratio, is an income-related ratio but is more adequate in capturing the perspective of an investor. While the largest part of reported earnings is kept in the company as reserve assets or as investment, dividends are disbursed to stock owners. This is particularly important for certain types of institutional investors, for example pension funds. For regulatory reasons, among others, pension funds are required to fulfill certain risk-related criteria when investing their funds. Additionally, due to the nature of their business they are obliged to regularly pay out funds. The D/P ratio gives stock owners relying on regular payouts an approach for stock selection. However, the D/P-ratio is possibly not the perfect measure to form value and growth portfolios. In section 2.4.1 Dividend Policy the most important argument against the validity of the D/P ratio is mentioned. From the perspective of portfolio construction, the D/P ratio has another issue. The dividends are announced after the fiscal year ending. Without any adjustments to the portfolio construction the D/P-ratio´s explanatory power is questionable, as it is announced in the time period it should explain.

The C/P-ratio is a suitable accounting measure to cover the perspective of an investor. Cashflow-statements are less subject to management decisions and agency factors. The operative cashflow is an accounting figure closely related to the profitability of a company. Therefore, as a third stock selection criteria, the C/P ratio is used and no portfolios are constructed based on the D/P ratio.

2.7: The Technical Analysis

The foundation today´s technical analysis is a series of articles by Charles H. Dow´s published in *Wall Street Journal* from 1900 until 1902. In these articles, Dow formulated his beliefs on the behavior of the stock market. In his opinion, the stock market´s behavior repeatedly follows patterns and contains information about the situation of the economy. Identification, classification and analysis of charts enable investors to identify trend driving factors in order to estimate future stock price movement. Dow´s idea of stock market analysis partially supports the EMH, as in his opinion the stock market as a whole reflects the business condition. Following this argument, the *Dow Jones Transportation Average Index* contains the 20 largest stocks of transportation corporations. In comparison, a hypothetical fundamental approach to assess the economic situation of the transportation business can be the aggregated amount of goods transported by air, train and road. At the same time Dow was convinced that past price movements follow patterns and in combination with trading volumes can be used to predict future price movements, an assumption of theory of technical analysis contradicting the EMH and deriving from natural and social sciences[53]. Newton´s first law of motion, the law of inertia[54] dictates that "The *vis insita*, or innate force of matter, is a power of resisting by which every body, as much as in it lies, endeavours to preserve its present state, whether it be of rest or of moving uniformly forward in a straight line"[55], a justification for the existence and predictability of trends. Group and investor psychology, as more deeply explained in 2.5 Over- and Underreaction and 2.4.2 Herding, to technical analysis are important aspects to consider, while fundamental analysts like Graham and Dodd 1934 brand concepts based on psychology as unpredictable and speculation as shown in Figure 4.

Until today, an immense number of indicators have been developed and are used to predict the future behavior of stock markets, stock indices or of an individual stock. One of the first and still most important patterns of stock movements is the trend, which will be explained in this section.

[53] Montassér (2000)

[54]Newton (1999)

[55]Newton et al (1850), p.27

As shown in Figure 5, a primary upwards trend consists of consecutive up and down movements and according to Dow lasts from one up to three years. The prevailing long-term upwards movement shown in Figure 5 ascribed to the primary trend is interspersed with opposing intermediate secondary trends lasting up to three months. Since the secondary trend is weaker, the primary trend defines the long-term direction of the movement of the stock[56].

The upwards primary trend can be decomposed in three phases: accumulation phase, public participation phase and the excess phase. According to Dow Theory the phases are characterized by the type of investor acquiring the stocks. During the accumulation phase, well informed and astute investors recognize that past negative information is enclosed in the stock or index price and the trend is about to change direction. Once the change of direction manifests in the chart, in the participation phase a broader circle of investors identify and anticipate the upwards trend. Finally, in the excess phase future expectations of the development of stock or index prices are mainly driven by speculation and the prevailing opinion that the current trend will perpetuate. In this phase, the well informed and astute investors start selling their positions as the primary trend is about to turn.[57]

[56] Murphy (2000)

[57] Murphy (2000)

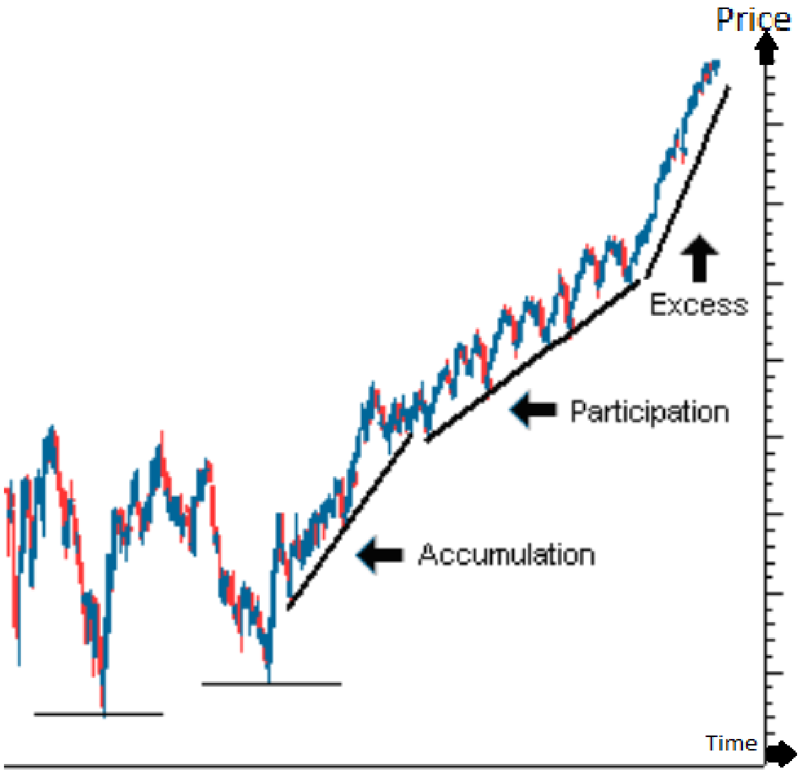


Figure 5: Phases of an upwards trend. Chart by MetaStock. Source: http://www.investopedia.com/university/dowtheory/dowtheory3.asp

From an academic perspective, the technical analysis is difficult to justify or to align with economic theory. Scholars devote their attention to technical analysis due to the fact that it is widely used by practitioners around the globe. Grindblatt and Titman (1989, 1993) find that a majority of mutual funds examined in their studies tend to select stocks that experienced an increase in price over the previous quarter. Copeland and Mayers (1982) and Stickel (1985) refer to the predictive power of Value Line rankings, while "Value Line rankings are known to be based in large part on past relative strength."[58] Since practitioners´ income and employment rely on the functionality of technical indicators, scholars have accepted the right to exist of technical analysis. Technological progress, especially information and data processing, has enabled science to dedicate enhanced research to technical analysis in order to develop and improve the theoretical framework. Still, it is important to keep in mind that technical analysis originally derives from empiricism.

[58] Jegadeesh and Titman (1993)

2.7.1 The Technical Model: Momentum Strategy

The foundation of momentum strategies is the existence of trend-behavior of stock markets. The theory section of this work has mentioned and explained reasons from the field of behavioral finance and agency factors deriving from institutional economics for the existence of trend behavior in stock market prices. In practice, scholars and practitioners have conducted quantitative research on historic stock market data. In order to capitalize the trend-behavior, scholars and practitioners identified various stock patterns and developed stock selection criteria to generate abnormal returns. The Momentum Strategy selected in this work as representative for technical analysis is presumably the oldest and most known: Identifying a stock price movement that, for a certain amount of time, will prevail in the future. These strategies are referred to as momentum- or relative strength strategies. Compared to momentum strategies, contrarian strategies capitalize on trends of stock price movements by capitalizing on mean reversion. Mean reversion dictates that in the long term, stock prices tend to converge to their average price.[59] Following this argument, stocks with current low prices will experience a raise in price and vice versa. This part of market theory is an incremental aspect of value-investing and shows that in both fundamental and technical analyses the concept of value-investing is present.

One of the major researches regarding momentum strategies was conducted by Jegadeesh and Titman (1993). In this study, the authors rank stocks based on their return performance in the last one, two, three and four quarters and develop a long-short zero-cost trading strategy. Stocks with past high performance are bought and held while at the same time stocks with past low performance are sold. The selected stocks are held and shorted, respectively, for one, two, three and four quarters. A combination of the varying holding/shorting periods results in a set of 16 strategies. The stock selection period can be linked to the accumulation-phase in 2.7: The Technical Analysis, while the holding phase of the portfolio can be linked to the phases of participation and excess. Section *3.3.2 Momentum Strategy* the stock selection of Jegadeesh and Titman (1993) will be applied. However, researchers are debating about the time span over which relative strength strategies generate abnormal return. The momentum studies of Jegadeesh and Titman

[59] Poterba and Summers (1988).

(1993) find that the combination of 6-month identification period and 6 month holding period generate the highest returns. However, studies done by DeBond and Thaler (1985) show that contrarian strategies generate higher returns on investment after a longer holding period of 3-5 years.

For further research and evidence on momentum strategies, the author refers to the list of the summary of findings in momentum literature by Noerregard (2008).

Authors	**Year**	**Country/ Region**	**Stock Data**	**Sample period**	**Summary of principal findings**
Jeegadesh & Titman	1993	USA	NYSE and AMEX	1965-1989	- Delayed price reaction to firm specific information.
Chan, Jeegadesh & Lakonishok	1996	USA	NYSE, AMEX & Nasdaq	1977-1993	- Price momentum is significant and cannot be explained by earnings momentum.
Rouwenhorst	1998	Europe	2,190 companies in 12 different European countries	1980-1995	- Momentum profits in all 12 countries. - Momentum profits are driven by a common component.
Rouwenhorst	1999	Africa, Asia, Europe & South America	1,750 companies in 20 different emerging market countries	1975-1997	- Price momentum factors in emerging markets similar to those in developed markets.
Moskowitz & Grinblatt	1999	USA	NYSE, AMEX & Nasdaq	1963-1995	- Industry momentum strategies more profitable than industry neutral strategies.
Liu, Strong & Xu	1999	UK	London Stock Exchange	1977-1996	- Strong momentum effects in the UK stock market.
Jeegadesh & Titman	2001	USA	NYSE, AMEX & Nasdaq	1965-1998	- Findings consistent with the 1993 study.
Grundy & Martin	2001	USA	NYSE, AMEX & Nasdaq	1926-1995	- Industry effects not the main cause of momentum profits.
Dijk & Huibers	2003	Europe	15 different countries	1987-1999	- Price momentum strategies profitable across European markets.
Griffin, Ji & Martin	2003	Africa, Asia, Australia Europe, North America & South America	12,276 companies in 40 different countries	1926-2000	- Price momentum profits are large in most countries.

Table 2: Summary of Findings in Momentum Literature. Source: Noerregard (2008), p. 38

3. Method

3.1 Data Collection and Calculations

The data is gathered through a data terminal of Bloomberg L.P. Using the EQS-functionality, the contemplable stocks of the S&P 500 index are identified by the following criteria

- Trading status: active
- Index: S&P 500 Index

Dependent on what model is evaluated, a third search criterion is added to identify the stocks of a specific portfolio. The model-specific criteria are mentioned in 3.3 Portfolio construction. To analyze the models in the time period of 1996 – 2016 requires stock prices in a quarterly interval for the time period of beginning of 1994 until end of 2016, as the longest identification period of the momentum strategy is 1 year. These data are accessed by using the Backtest (EQBT)-functionality of Bloomberg to create portfolios. This allows a validation of the investment strategies on historic stock market data. To account for the size effect (Banz 1981), the portfolio construction in this work varies between equally-weighted and value-weighted stocks in the portfolios. This measure is taken in respect of the variety of the size, measured in market cap, of the stocks in the S&P 500. The portfolios are held for a year without rebalancing. This measure puts the results of this work from the academic perspective of the EMH closer to a realistic perspective, as transaction costs would harm the profitability of the portfolios.
As a result, in this work there will be 4 variations of the momentum strategy and 3 variations of the fundamental strategy. With consideration of the value weighted and equally weighted variations, 14 strategies in total are subject of the analysis.

Bloomberg provides the portfolio`s beta-coefficients of the CAPM-Model and the Sharpe-ratios. These values are calculated using daily returns over the model run and are more precise than a calculation based on yearly returns. Therefore, in section 4. Analysis, the beta-coefficients and Sharpe-ratio values provided by Bloomberg will be used.

The t-statistics and geometric means are calculated using Microsoft Excel 2016 on the basis of the yearly returns of the portfolios and the S&P 500.

The results of Fama and French (1998) are adjusted with the 3-month US treasury bill to make them comparable to the results of this work.

3.1.1 Data issues

The data has not been cleared of illiquid stocks, e.g. stocks that show a low trading volume. It is possible that some of the stocks analyzed have very little price movement, which falsifies the results of this work.

The EQS-functionality is considering the data available at any given point in time and looks at the data as it was available. Therefore, the data analyzed is not subject to survival ship bias.

Dividends are reinvested to maintain the weight of the portfolios. Annual returns are reported in the analysis section, therefore the reinvesting of dividends has no impact on the figures.

3.2 Limitations

This section mentions the limitations due to the scope and time available. This mostly affects the data collection of the momentum strategy and the analysis of the results. Two different investment strategies are subject of this work. This makes it necessary to reduce the data collected while at the same time establish a frame for comparison. The factor that allows for a comparison of the profitability of the investment strategies is the holding period of one year. The academic research of value-investing strategies predominantly uses a one year holding period. However, the time sensitivity of the momentum literature demands a variation of identification and holding periods. Specifically, the momentum strategy developed by Jegadeesh and Titman (1993) contains in total 16 variations. Adjustments for price pressure, lagged-price reactions, monthly portfolio creations and sub-samples to further investigate on company size are outside of the scope of this work. The variation of identification and holding period of 1, 2, 3 and 4 quarters totals in 16 permutations. Setting the holding period to one year reduces the momentum strategy to 4 variations. Furthermore, this work changes the zero-cost trading strategy into a buy-and-hold strategy for comparative reasons between the fundamental and technical strategy.

The construction of the value-investing portfolios to a large extent is conducted as Fama and French (1998). The variation in this work is that no portfolios are created based on the D/P ratio for reasons stated in 2.6.1.3 C/P.

Analyzing the portfolios is subject of 4. Analysis of this work. Researchers in academic literature go one step further. Developing forward looking explanatory models based on the findings of the analysis of historic stock market prices is the second part of academic literature. In this work, no regression analysis is conducted to develop such a model which determines the explanatory power of single factors and has explanatory power to explain future stock price movement.

- Value portfolio higher risk?
    - CAPM,
    - Method to adjust for higher risk by Lakonishok, Chan 1994 beause beta a crude proxy
- Stock selection biased?
    - More sophisticated approach in Lakonishok, Chan 2004 p.81,
-

3.3 Portfolio construction

3.3.1 Value Investing

The value-investing portfolios of the fundamental model are created with the following third search criteria in Bloomberg EQS-function:

- Book-to-Market Ratio
    - Book-to-Market ratio, last close
    - Percentile, sequential, higher value is better
    - Top, 3, decile(s)

This setup identifies the 30% of stocks that have the highest Book-to-Market ratio in accordance to the research conducted by Fama and French (1998). Respectively, the stock selection and portfolio construction based on the E/P and C/P ratios is conducted:

- Earnings-Price-Ratio,
    - Earnings-Price-Ratio, last close
    - Percentile, sequential, higher value is better
    - Top, 3, decile(s)

And

- Cashflow-Price-Ratio,
  - Cashflow-Price-Ratio, last close
  - Percentile, sequential, higher value is better
  - Top, 3, decile(s)

Once the stock selection criteria are set, the Backtest (EQSBT)-functionality is used to apply the stock selection on historic stock market data of the years 1996 – 2016.
The configuration of the Backtest-functionality is set up as follows:

- Analysis Period
  - Time frame: exact 1/1/1995 – exact 12/31/2016
  - Rebalancing frequency: End of year

This setup automatically chooses the first trading day of each year. If US-Stock exchanges are closed on the1st of January of any year, the first consecutive trading day is chosen to calculate the return of the portfolio. Respective, if US-Stock exchanges are closed on the last day of a year, the return calculation considers the first trading day of the consecutive year.
The portfolios with stocks weighted with their market cap are created with the following setup:

- Analysis Parameter for value-weighted portfolios
  - Portfolioweight: value weighted with market cap
  - Benchmark: S&P 500 Index (SPX)
  - Currency: USD

The portfolios with equally weighted stocks are created with the following setup:

- Analysis Parameter for equally-weighted portfolios
  - Portfolioweight: equally weighted
  - Benchmark: S&P 500 Index (SPX)
  - Currency: USD

All returns are calculated and stated in USD. The S&P 500 is a fitting benchmark because it represents about 75% of U.S. market capitalization. Compared to the S&P 500 Total Return Index, the S&P 500 Index does not consider dividend payouts. For reasons stated in 2.4.1 Dividend Policy the S&P 500 is used as benchmark.

For every year and each ratio between 1996 and 2016 equally weighted and value weighted portfolios are created, totaling in 120 portfolios. The data exported contains information about the periodic returns and rebalancing for every single year. For the data analysis the Sharpe-ratio Bloomberg provides is used. It is calculated with the 3-month US-Treasury Bill as risk-free rate on the basis of the daily deviation of the portfolio returns.

3.3.2 Momentum Strategy

The momentum strategy portfolios of the technical model are created with the following third search criteria in Bloomberg EQS-function:

- Change in Price in %, Q-1 closing price
  - Percentile, sequential, higher value is better
  - Top, 1, decile(s)

This setup identifies the 10% of stocks which experienced highest price increase of the S&P 500 stocks in the last 3 months. The increase in price is measured as the difference between the closing prices on the day of the portfolio formation and the closing price 3 months prior. To account for varying identification periods, the search criteria are changed to

- Change in Price in %, Q-2
  - Percentile, sequential, higher value is better
  - Top, 1, decile(s)

for a 6-month identification period and

- Change in Price in %, Q-3
  - Percentile, sequential, higher value is better
  - Top, 1, decile(s)

for a 9-month identification period and

- Change in Price in %, Q-4
  - Percentile, sequential, higher value is better
  - Top, 1, decile(s)

for a 12-month identification period.

The setup for the Backtest-functionality is identical to the setup of the value-investing portfolio. For every year and each identification period between 1996 and 2016 equally weighted and value weighted portfolios are created, totaling in 160 portfolios.

4. Analysis

The analysis section contains three comparisons. First, the results of the value investing strategy of this work are compared to the results of the reference study by Fama and French (1998).

Then, the results of the momentum strategy by Jegadeesh and Titman (1993) are compared with the results of this work.

Finally, both the value investing portfolios and the momentum strategy portfolios for the time period 1996 – 2016 are compared to each other.

Risk is addressed with two different approaches. On the one hand the classic approach based on the deviation of returns over time. The other approach is specifically comparing the performance of returns in economically unfavorable times, which are defined as the years where the S&P 500 reported it´s highest losses.

4.1 Value Investing Strategy

Table 3 shows the annual returns in percent of the value investing strategies for the time period of 1996 – 2016 and the return of the S&P 500. The top row indicates the length of the identification period for each portfolio and whether the stocks in the portfolio are value or equally weighted. The holding period for each portfolio is one year.

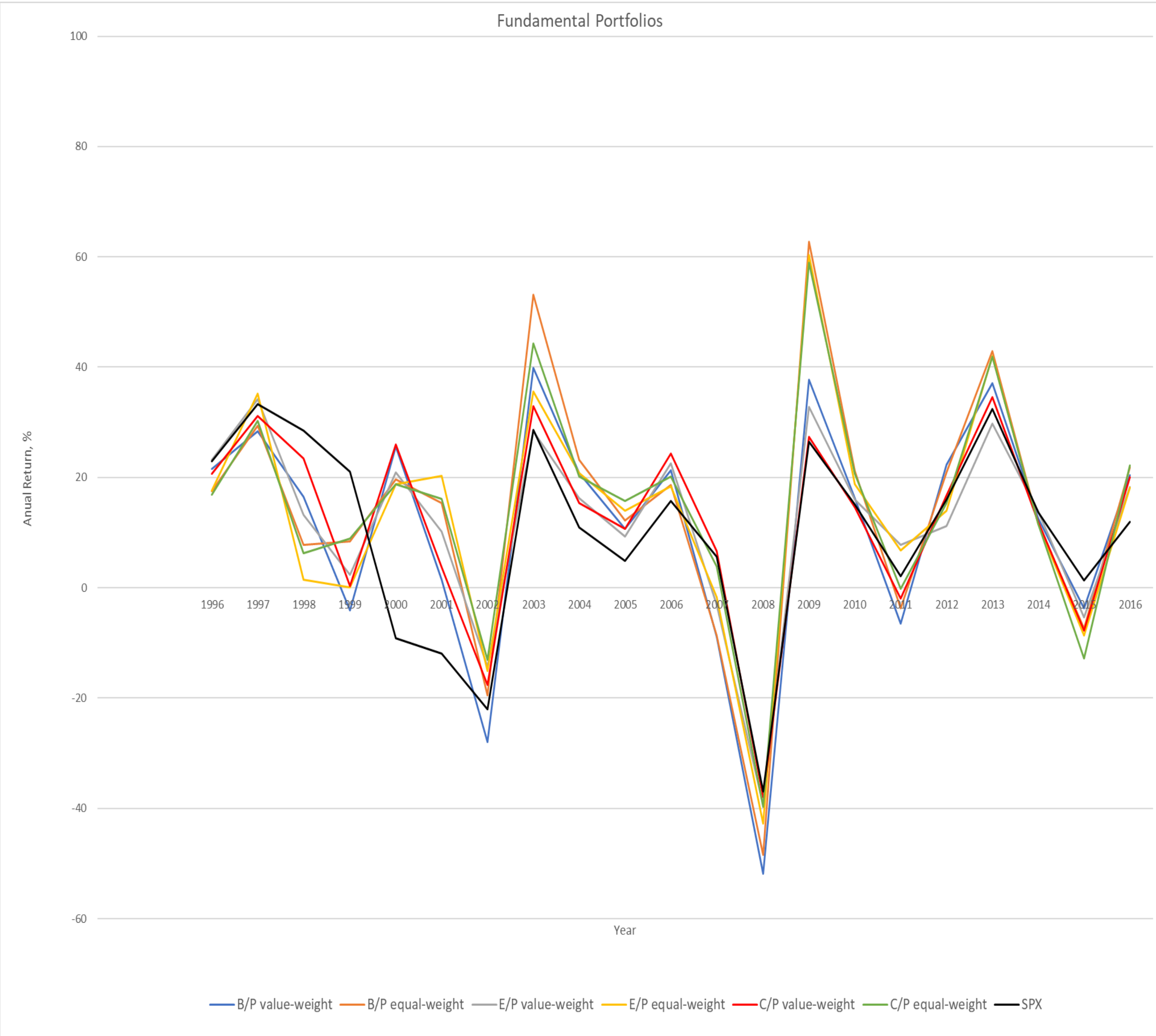
Year	B/P value-weight	B/P equal-weight	E/P value-weight	E/P equal-weight	C/P value-weight	C/P equal-weight	SPX
1996	21,5673	17,5312	23,1577	17,5953	20,6297	16,8415	22,908
1997	28,3425	29,4273	34,2467	35,2202	31,1614	30,3071	33,3239
1998	16,5426	7,7663	13,2356	1,4103	23,4266	6,3129	28,5497
1999	-4,0744	8,4071	2,3536	0,0574	0,2888	8,9017	21,0364
2000	25,5919	19,6311	20,8972	18,791	25,956	18,7122	-9,1014
2001	1,4983	15,36	10,1511	20,3228	3,7073	16,1198	-11,89
2002	-28,0299	-19,5196	-14,2757	-15,0545	-17,611	-13,0752	-22,098
2003	39,8187	53,0955	28,3414	35,5158	32,9734	44,3047	28,6648
2004	20,7928	23,132	16,2575	20,7801	15,3666	20,1067	10,8758
2005	10,639	12,1925	9,2604	13,9638	10,7276	15,7294	4,9075
2006	21,2848	18,6188	22,5741	18,4141	24,348	20,1012	15,7765
2007	-8,8502	-8,6036	-3,0858	-1,7225	6,5905	3,8088	5,571
2008	-51,9175	-48,4234	-39,3939	-42,7218	-37,9105	-39,6825	-36,999
2009	37,6874	62,6814	32,833	60,3189	27,3024	59,0012	26,4478
2010	16,2036	21,1384	16,0005	18,8094	14,6192	20,6847	15,058
2011	-6,4404	-3,7778	7,8287	6,783	-1,9615	-0,1985	2,1054
2012	22,2982	20,8942	11,1356	14,0258	16,7238	15,403	15,9937
2013	37,1004	42,8656	29,734	41,9778	34,615	41,8904	32,3763
2014	12,5882	11,7528	13,7913	11,591	11,9147	11,6289	13,68
2015	-3,731	-7,3948	-5,3062	-8,6264	-7,7932	-12,7566	1,3749
2016	20,4511	21,7832	18,2468	18,1277	20,0651	22,2194	11,9524

Table 3: Return in % of the value portfolios and the S&P 500

	B/P value-weight	B/P equal-weight	E/P value-weight	E/P equal-weight	C/P value-weight	C/P equal-weight
t statistic SPX	0,75	0,22	0,46	0,29	0,36	0,15
t statistic equal value	0,07		0,32		0,25	

Table 4: t-test of the value investing portfolios

Table 4 shows t-statistics for each portfolio and the S&P 500 index as well as t-statistics for the value and equally weighted portfolios with identical identification period. With a confidence interval of 5%, the average returns of the portfolios and the S&P 500 are not significantly different. If the confidence interval is set to 10%, only the B/P value-weight and the B/P equal-weight are statistically of significant difference. These two portfolios are the only portfolios in the data gathered which report a statistically significant difference in annual returns.



Graph 1: Returns in % of value investing Strategies and the S&P 500 from 1996 - 2016

Graph 1 shows the annual returns of the momentum portfolios over the time period 1996 – 2016 and the development of the S&P 500.

Similar to the momentum portfolios, the time observation period can be divided into two segments. The first from 1996 – 2006 and the second from 2007 – 2016. In the first segment, the value investing portfolios correlate less with the S&P 500, especially in periods with relatively low or negative returns. All value investing portfolios perceptibly underperform the S&P 500 in the years 1998 and 1999 while overperforming in the two consecutive years.

In the second segment from 2007 – 2016 all value investing portfolios behave similarly to each other and the S&P 500 with higher volatility. The value investing portfolios report higher positive and lower negative returns compared to the S&P 500.
The only exceptions to this pattern are the E/P value and equally weighted portfolios in 2011 and 2012 as well as the E/P value weighted portfolio in 2013.

The highest annual returns of about 60% among the value investing strategies are realized in 2009 by equally weighted portfolios.

It is likely that global political and economic events impact the returns of the value investing strategies. Such as the bursting of the Dot-Com bubble, the terror attacks of September 11th, the war in Iraq in 2003 or the introduction of the Euro-Currency in the European Union, which is the most important trading partner of the US economy.

	B/P value-weight	B/P equal-weight	E/P value-weight	E/P equal-weight	C/P value-weight	C/P equal-weight
geometric mean return	8,18	11,39	10,30	11,40	10,54	12,51
Standard Deviation	19,81	19,09	17,78	18,36	17,67	18,02
Beta	1,10	1,06	1,01	1,02	1,00	1,00
Sharpe-Ratio	0,32	0,44	0,41	0,45	0,42	0,50

Table 5: risk and annual returns in % of the value investing portfolios

Table 5 shows the risk and return figures for the value investing strategies. The Sharpe-ratio of the equally weighted portfolios is higher than for the corresponding value weighted portfolios. This indicates the existence of the size-effect described by Banz (1981).
Within the group of value investing portfolios, the standard deviation varies less than the geometric mean return.
Although all companies in the S&P 500 belong to the group of largest corporations in the US, there are still significant differences within these 500 stocks. In 2018, roughly the smallest 20

companies in the S&P 500 together have the same weight as the largest company, Apple, with a weight of more than 4%.

The highest Sharpe-Ratio of 0,50 is achieved by the equally weighted C/P portfolio.

	B/P value-weight	B/P equal-weight	E/P value-weight	E/P equal-weight	C/P value-weight	C/P equal-weight	SPX
Year							
2002	-28,03	-19,52	-14,28	-15,05	-17,61	-13,08	-22,10
2008	-51,92	-48,42	-39,39	-42,72	-37,91	-39,68	-37,00
Standard Deviation	19,81	19,09	17,78	18,36	17,67	18,02	

Table 6: Comparison of risk-measures

In the year 2002 only the B/P value-weighted portfolio reported higher losses than the S&P 500. In 2008, all portfolios reported higher losses than the S&P 500. This indicates that in 2002 with the exception of the B/P value-weighted portfolio, the concept of Graham and Dodd´s (1934) "margin of safety" applies to value-stocks. The fact that all value-investing portfolios underperformed the S&P 500 in the year 2008 is an indication that the financial crisis of 2008 was so severe that the "margin of safety" did not protect investors from market declines.

Table 7 compares the annualized monthly returns in percent of the corresponding value-weighted buy-portfolios of the research by Fama and French (1998) which examined the time period of 1975 – 1995 with the results of this work.

	Fama and French (1998)		**Daniels (2018)**	
	Annual Return in %	Standard-Dev.	Annual Return in %	Standard-Dev.
B/P	21,72	16,92	8,18	19,81
E/P	21,26	18,10	10,30	17,78
C/P	20,91	16,73	10,54	17,67
Sharpe-Ratio				
B/P	1,28		0,32	
E/P	1,17		0,41	
C/P	1,25		0,42	

Table 7: Annual returns in %, Standard Deviation and Sharpe-Ratio

The annual returns of the value-portfolios of Fama and French (1998) have been adjusted with the annualized, not seasonally adjusted US 3-month treasury bill of the secondary market. The Sharpe-ratio for the Fama and French portfolios has been calculated with the excess return and standard deviation provided by Fama and French (1998). The Sharpe-Ratio of the Daniels (2018) portfolios is provided by Bloomberg.

When looking at the Sharpe-Ratio of the portfolios, the Fama and French (1998) portfolios drastically outperform the corresponding portfolios of this work. This outperformance is mainly driven by higher reported annual returns of the Fama and French (1998) portfolios. With 21,72% to 8,18% for the B/P, 21,26% to 10,30% for the E/P and 20,91% to 10,54% the Fama and French portfolios report returns twice as high as the portfolios examined in this study. The Standard-Deviations of the Fama and French portfolios doesn´t differ that much.

4.2 Momentum Strategy

Table 8 shows the annual returns in percent of the momentum strategies for the time period of 1996 – 2016 and the return of the S&P 500. The top row indicates the length of the identification period for each portfolio and whether the stocks in the portfolio are value or equally weighted. The holding period for each portfolio is one year.

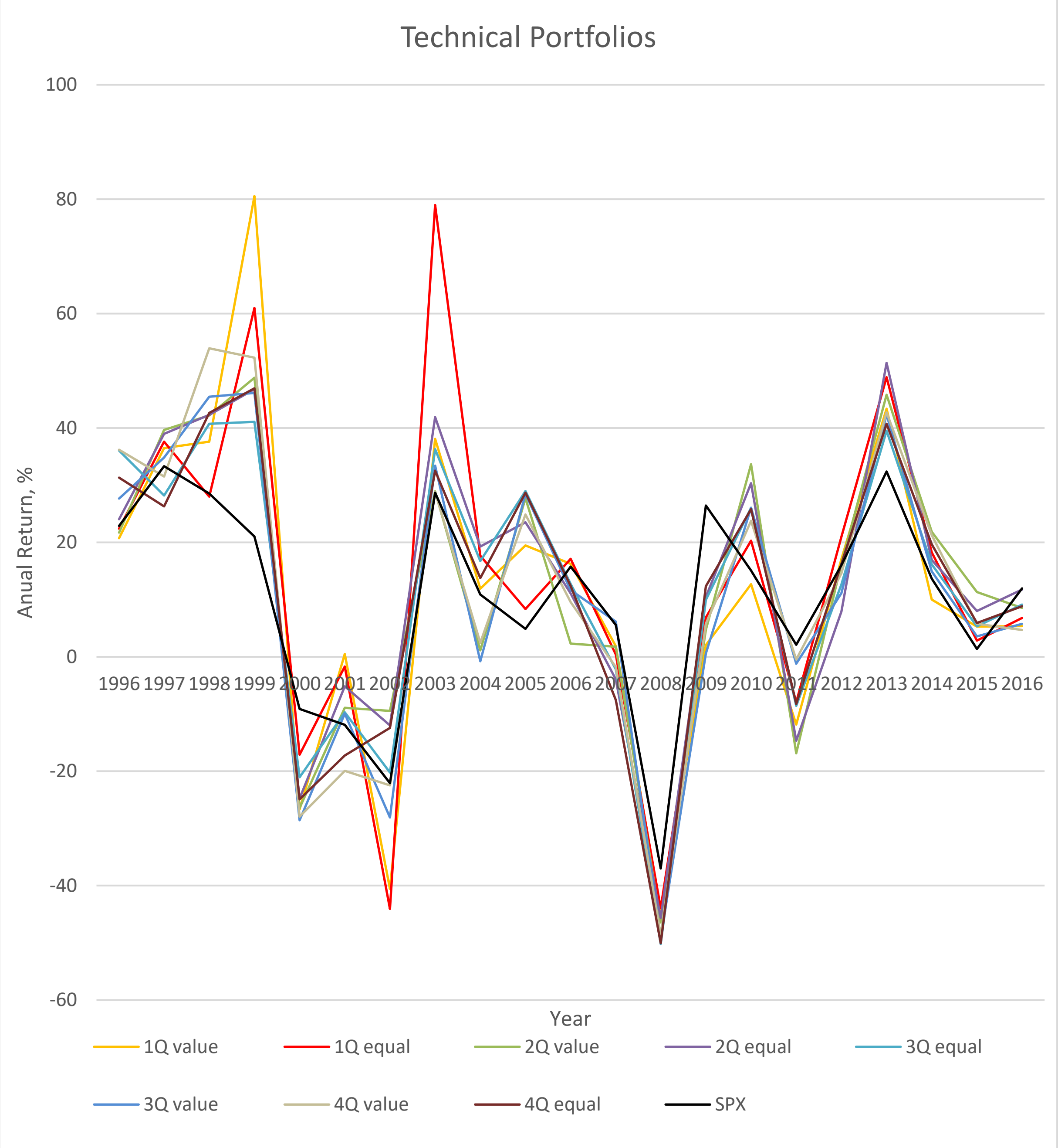
Year	1Q value	1Q equal	2Q value	2Q equal	3Q value	3Q equal	4Q value	4Q equal	SPX
1996	20,72	22,42	21,71	24,07	27,68	36,05	36,20	31,32	22,91
1997	36,51	37,59	39,66	39,00	34,82	28,19	31,52	26,29	33,32
1998	37,61	27,98	42,18	42,31	45,45	40,73	53,93	42,62	28,55
1999	80,54	60,96	48,79	46,78	46,13	41,08	52,31	46,94	21,04
2000	-26,68	-17,09	-26,43	-24,77	-28,56	-21,08	-27,95	-24,93	-9,10
2001	0,51	-1,71	-8,93	-5,18	-9,95	-9,71	-19,94	-17,27	-11,89
2002	-40,58	-44,07	-9,46	-11,98	-28,07	-20,23	-22,45	-12,43	-22,10
2003	38,09	78,98	28,95	41,89	33,42	36,32	28,82	32,53	28,66
2004	11,91	17,69	1,14	19,26	-0,79	16,72	2,43	13,78	10,88
2005	19,47	8,37	27,69	23,50	28,43	28,97	24,88	28,69	4,91
2006	16,27	17,14	2,32	11,07	11,69	12,75	9,58	12,39	15,78
2007	1,85	0,38	1,77	-3,94	6,16	-2,18	-1,81	-7,54	5,57
2008	-44,78	-43,95	-46,44	-45,62	-49,17	-50,20	-48,68	-50,06	-37,00
2009	2,08	6,91	4,74	10,45	0,61	9,97	5,80	12,35	26,45
2010	12,67	20,30	33,67	30,32	26,08	26,03	23,77	25,82	15,06
2011	-11,83	-7,92	-16,86	-14,66	-1,22	-8,57	-0,48	-8,21	2,11
2012	17,10	20,96	16,32	7,89	11,13	12,63	14,60	16,25	15,99
2013	43,35	48,88	45,80	51,39	42,35	39,53	42,72	40,73	32,38
2014	10,01	18,27	21,88	16,95	14,96	16,14	21,28	19,64	13,68
2015	5,26	2,85	11,32	8,02	3,59	5,33	5,78	5,92	1,37
2016	5,36	6,77	8,55	11,75	5,76	9,15	4,70	8,84	11,95

Table 8: Return in % of the momentum portfolios and the S&P 500

	1Q value	1Q equal	2Q value	2Q equal	3Q value	3Q equal	4Q value	4Q equal
t statistic SPX	0,75	0,36	0,56	0,25	0,87	0,46	0,67	0,55
t statistic equal value	0,38		0,31		0,36		0,80	

Table 9: t-test of the momentum portfolios

Table 9 shows t-statistics for each portfolio and the S&P 500 index as well as t-statistics for the value and equally weighted portfolios with identical identification period. With a confidence interval of 5%, the average returns of the portfolios and the S&P 500 are not significantly different.



Graph 2: Returns in % of Momentum Strategies and the S&P 500 from 1996 - 2016

Graph 2 shows the annual returns of the momentum portfolios over the time period 1996 – 2016 and the development of the S&P 500. One feature of the graph are the altering correlations of the portfolios with the S&P 500 over time.

In the time period 1996 – 2005 the 1Q value and 1Q equal portfolios show a much more significant deviation from the S&P 500.

The extreme deviations of the portfolios with an identification period of 1 quarter indicate that over- and underreaction power momentum which drives the stock market in a relatively short time frame of 3 months. Due to the fact that other portfolios have a longer identification period, over- and underreaction effects get equalized by natural adjustments over a medium-term identification period of 6 to 12 months.
Especially in the years 1999 and 2003, respectively, the portfolios which select the stocks according to the past performance of the last quarter report the highest annual returns (80,54% and 78,98% respectively) of the whole data.
A possible explanation for this is that in the 1Q identification period prior to these years, particular strong, but short-term momentum was driving stock prices. It might be interesting to note that in 1999 the value-weighted 1Q portfolio outperformed all other momentum portfolios and the S&P 500, while in 2003 the equally-weighted 1Q portfolio reported the highest returns. A possible explanation of this could be that after the Dot-Com bubble, investors changed their investment patterns and allocated more funds into stocks with a smaller market capitalization when the market recovered in 2003.

These extreme swings could also be explained by an underlying fundamentally higher risk, as these 2 portfolios report significantly higher losses in the year 2002. One possible explanation for this could be the collapse of the Dot-com bubble. Another possible explanation is the effect of global political events on the stock market, such as the terror attacks of September 11th in 2001, the subsequent war in Iraq 2003 or the introduction of the European single currency €, as the Euro-Zone is the most important trading partner for the US-economy.

	1Q value	1Q equal	2Q value	2Q equal	3Q value	3Q equal	4Q value	4Q equal
geometric mean return	7,42	9,39	8,81	10,25	7,23	8,82	7,85	8,52
Standard Deviation	21,51	21,75	20,49	21,28	21,31	20,86	21,12	21,18
Beta	1,16	1,18	1,10	1,14	1,11	1,12	1,12	1,14
Sharpe-Ratio	0,28	0,35	0,33	0,38	0,28	0,33	0,30	0,32

Table 10: risk and annual returns in % of the momentum portfolios

When comparing the Sharpe-ratio of the value weighted and equally weighted portfolios, the equally weighted portfolios constantly outperform the value weighted portfolios as shown in Table 10. A possible reason for this can be the size effect (Banz 1981), since equally weighted portfolios put a higher weight on stocks with smaller market capitalization than value weighted portfolios.

In the time period 2006 – 2016, the momentum portfolios reported more homogeneous returns. The development of the portfolios mostly behaved similarly to the S&P 500. During the crises in 2008 and 2011 all momentum portfolios were underperforming in comparison to the S&P 500. In 2010 and 2013, all portfolios outperformed the S&P 500 with one exception, the 1Q value portfolio in 2010. This also indicates the existence of over- and underreaction in the stock market. However, after the 2008 crisis the 1Q value and 1Q equally-weighted portfolios stop producing outliers. This could mean that investors changed their behavior and have less trust in strong but short-term trends.

	1Q value	1Q equal	2Q value	2Q equal	3Q value	3Q equal	4Q value	4Q equal	SPX
2002	-40,5796	-44,0742	-9,4587	-11,9837	-28,0739	-20,2253	-22,4549	-12,4289	-22,0978
2008	-44,7759	-43,9469	-46,4357	-45,6203	-49,1736	-50,2014	-48,6824	-50,063	-36,9993
Standard Deviation	21,51	21,75	20,49	21,28	21,31	20,86	21,12	21,18	

Table 11: Comparison of risk-measures

The alternative risk-measure according to Lakonishok et al (1994) is applied in Table 11. It shows the performance of the momentum portfolios in economically unfavorable times, measured in annual return of the S&P 500 Index. In the time period between 1996 – 2016, the S&P 500 reported the biggest losses in 2002 and 2008. It is noticeable that in the year 2002, the 2Q value, 2Q equal and the 4Q equal portfolios reported a much lower loss than the S&P 500 and the other momentum portfolios. By comparison, in 2008, all of the momentum portfolios reported higher losses than the S&P 500.

The standard deviations of the portfolios for the time period of 1996 – 2016 are more homogeneous than the alternative risk measure. This indicates that over a longer observation period fluctuations caused by contemporary economic events are compensated.

Table 12 shows the annualized monthly returns in percent of the corresponding equally weighted buy-portfolios of the research by Jegadeesh and Titman (1993) which examined the time period of 1965 – 1989 with the results of this work.

	Jegadeesh Titman (1993)	Daniels (2018)
1Q	20,41	9,39
2Q	21,84	10,25
3Q	21,56	8,82
4Q	20,27	8,52

Table 12: Annual returns in %.

The results show that in the time period of 1965 – 1989 the buy-portfolios recorded much higher annual returns than in the time period of 1996 – 2016. However, since Jegadeesh and Titman (1993) did not evaluate risk measures for each portfolio of their research, risk-adjusted returns cannot be compared. Still, it is interesting to note that in both time periods the portfolio with an identification period of 2Q reports the highest returns.

4.3 Comparison of the Momentum and Value Investing strategies

Six momentum and eight value investing strategies for the time period of 1996-2016 are subject to this comparison made in order to answer the research question of this thesis. In section 4.1 Value Investing Strategy" and section The annual returns of the value-portfolios of Fama and French (1998) have been adjusted with the annualized, not seasonally adjusted US 3-month treasury bill of the secondary market. The Sharpe-ratio for the Fama and French portfolios has been calculated with the excess return and standard deviation provided by Fama and French (1998). The Sharpe-Ratio of the Daniels (2018) portfolios is provided by Bloomberg.

When looking at the Sharpe-Ratio of the portfolios, the Fama and French (1998) portfolios drastically outperform the corresponding portfolios of this work. This outperformance is mainly driven by higher reported annual returns of the Fama and French (1998) portfolios. With 21,72% to 8,18% for the B/P, 21,26% to 10,30% for the E/P and 20,91% to 10,54% the Fama and French portfolios report returns twice as high as the portfolios examined in this study. The Standard-Deviations of the Fama and French portfolios doesn´t differ that much. 4.2 Momentum Strategy" the data analysis strongly indicates the existence of the size effect for both strategies. To account for this finding both strategies are split into two groups: equally weighted and value weighted portfolios. Then, they are compared to the corresponding portfolios of the other investment strategy. Since the deviations within each group regarding return and standard deviation are low, the comparison is made using average values. This method also allows for an easier comparison between the two groups. The results of the comparison are summarized in Table 13.

	Value	**Momentum**
annual return in %		
average value weight	9,67	7,83
average equal weight	11,77	9,25
Standard Deviation		
average value weight	18,42	21,11
average equal weight	18,49	21,27
Sharpe-Ratio		
average value weight	0,38	0,30
average equal weight	0,46	0,35

Table 13: Comparison of value- and momentum portfolios in the years 1996-2016

According to the findings displayed in Table 13, value-portfolios have a higher Sharpe-Ratio than momentum portfolios. The difference in the Sharpe-Ratios is mainly due to the fact that value-portfolios report higher annual returns. The Standard Deviation also accounts for a small margin of this deviation, but the difference in Standard Deviations is very small, especially when considering the fact that the calculation of the Standard Deviation requires squaring.

Another conclusion drawn from the data is that equally weighted portfolios have a higher Sharpe-Ratio than the corresponding value-weighted portfolios. This indicates the existence of the size effect (Banz 1981). The Sharpe-Ratio of the equally weighted portfolios is mainly driven by a higher return and not by a higher underlying risk, measured in standard deviation. The conclusion of this finding is that relatively small companies in the S&P 500 are not subject to significantly higher risk than companies with large market capitalization.

Table 14 shows a comparison between the alternative risk-measure according to Lakonishok et al (1994) and the standard deviation of both strategies. Similar to the comparison previously drawn in this section, Table 14 compares the mean values of annual returns and standard deviation.

	average return		
year	**Momentum**	**Value**	**SPX**
2002	-23,66	-17,93	-22,10
2008	-47,36	-43,34	-37,00
Standard Deviaton	21,19	18,46	

Table 14: comparison of risk measures, value and momentum portfolios

Table 14 shows that value-portfolios also have a lower risk according to the alternative risk measure. The fact that Value-portfolios experienced less decline than the S&P 500 suggests that in the time period of 1996-2016 Graham and Dodd´s (1934) "margin of safety" exists.

5. Conclusion

Value-portfolios outperform momentum-portfolios by 1,84% annually in the time period 1996-2016. According to two different risk measures, value-portfolios bear lower risk than momentum portfolios. Over the entire observation period, value-portfolios report a lower standard deviation. Additionally, according to the alternative risk-measure (Chan and Lakonishok 2004) to the CAPM, value-portfolios are less susceptible to economic crises. This indicates the existence of the "margin of safety (Graham and Dodd 1934) which allowed value-investors to reduce their losses, especially in 2002, where the S&P 500 reported a minus of 22,10% while the value-portfolios only lost 17,93%. However, in 2008, the "margin of safety" could not protect investors from the significant market losses. Still, value-portfolios experienced lower losses compared to the momentum portfolios.

The companies listed in the S&P 500 are all large companies. Despite this, another noticeable finding is the existence of the Size effect by Banz (1984). No matter which investment paradigm is analyzed regarding the annual return, equally weighted portfolios always seem to outperform value-weighted portfolios. The differences in risk between the equally and value weighted portfolios are marginal. This results in higher Sharpe ratios for the equally weighted portfolios and indicates that the size effect not only exists between SMEs and large companies but also between the large and very largest companies.

Another factor that could be driving the performance of the strategies is the rate of US. Treasury bills. In the time period examined by Fama and French (1998), on average the annual US Treasury bill rate was 7,17%, while in the time period of 1996- 2016 the average rate was 2,25%. Similar for the momentum strategies analyzed by Jegadeesh and Titman (1993), the average annual US Treasury bill rate amounted to 7,05%. The average annual returns of Fama and French (1998) of 21,29% and of Jegadeesh and Titman (1993) of 21,02% are significantly higher than the annual returns of the portfolios of this work, with an average of 9,67% for the value-portfolios and 9,25% for the momentum portfolios. This correlates with the development of the US Treasury bill as the risk-free rate.

In contrast, the correlation of the return of the value and momentum portfolios with the S&P 500 appears to be very small. In the time period examined by Fama and French (1998) the annual average return of the S&P 500 was 16,34%. The research of Jegadeesh and Titman (1993) was applied on a time period when the S&P 500 reported an annual average return of 14,17%. In the time period examined in this work, the annual average return of the S&P 500 was 16,03%.

Another interpretation of the difference in annual return between the annual portfolio returns of Fama and French (1998) and Jegadeesh and Titman (1993) can be that the S&P 500 over the last decades became much more efficient, resulting a smaller impact of investors over-and underreaction on stock prices and less return of the strategies compared in this work.

While the t-test failed to determine statistical significance, the differences between the two examined strategies in annual returns and Sharpe ratio support the claim that value-investing is more profitable than momentum strategies. Additionally, when adjusting the confidence-interval of the t-test to 10%, it results in statistical significance when comparing the equally weighted and the value weighted B/P portfolios.

6. Further research

The impact of the US Treasury bill rate on the profitability of the portfolios requires more attention to rule out potential spurious correlations. The time period analyzed by previous research is predominately affected by the two oil crises which increased inflation which in turn increased the US Treasury bill rate. In comparison, after the 2008 Lehman-crisis, policymakers shifted into a long-term low interest rate policy which remains intact today. It is likely that this change of economic environment impacts the profitability of the portfolios in some way. To clarify, further research is needed.

To increase the statistical significance of the data analysis, a longer time period can be analyzed or portfolios could be formed on a monthly basis.

This work only formed and analyzed the value-portfolios of the value-investing strategy and the buy-portfolios of the momentum strategy. This method can be expanded by the additional creation of the growth-portfolios of the value-investing strategy in order to determine “value-premium”.
The creation of the sell-portfolios of the momentum strategy can be used in order to find out if next to positive momentum, negative momentum drives stock prices in the S&P 500 in the time period of 1996 – 2016.

This work uses the S&P 500 as a proxy for the US stock market. The studies compared in this work originally use data provided by the Center for Research in Security Prices and compustat, effectively applying the strategies on a large variety of stocks. The significance of the results can be improved by applying both stock selection strategies on these broader selection of stocks.

To contribute to the question, for how long a trend is driving stock prices, the observation period of the momentum strategy portfolios can be extended in order to determine when short term movements are replaced by long-term price reversals.

This work portrays the fundamental and technical analysis as two separate entities. Today, both of these investment paradigms together form “Fusion Analysis”. Combining the stock selection criteria of both the fundamental and technical models and applying it on the same data can contribute to the research about “Fusion Analysis”.

This work identifies heuristics and agency factors which impact investors behavior with the means of behavioral science. Neuroscience are a new, related field of study. Applying methods of neuroscience to complement behavioral science is a promising approach to further describe individuals’ behavior. This interdisciplinary approach has the potential to draw more precise conclusions about the impact and occurrence of heuristics and agency factors.

Sources

Arnold, G. (2008). *Corporate financial management*. Pearson Education.

Avramov, D., Kaplanski, G., & Levy, H. (2015). Talking Numbers: Technical versus Fundamental Recommendations. *Available at SSRN 2648292*.

Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of financial economics*, *9*(1), 3-18.

Barberis. N, Shleifer, A & Vishny, R.W. (1997). A Model of Investor Sentiment. Cambridge: National Bureau of Economic Research.

Basu, S. (1977). Investment performance of common stocks in relation to their price‐earnings ratios: A test of the efficient market hypothesis. *The journal of Finance*, *32*(3), 663-682.

Bettman, J. L., Sault, S. J., & Schultz, E. L. (2009). Fundamental and technical analysis: substitutes or complements?. Accounting & Finance, 49(1), 21-36.

Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *The Journal of Finance*, *43*(2), 507-528.

Bhushan, R. (1989). Firm characteristics and analyst following. *Journal of Accounting and Economics*, *11*(2-3), 255-274.

Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of finance*, *40*(3), 793-805.

Campbell, J. Y. (2000). Asset pricing at the millennium. *The Journal of Finance*, *55*(4), 1515-1567.

Chan, L. K., & Lakonishok, J. (2004). Value and growth investing: Review and update. *Financial Analysts Journal*, *60*(1), 71-86.

Chan, L. K., Hamao, Y., & Lakonishok, J. (1991). Fundamentals and stock returns in Japan. The Journal of Finance, 46(5), 1739-1764.

Chirkova, E. (2015). The Warren Buffett philosophy of investment : how a combination of value investing and smart acquisitions drives extraordinary success. McGraw-Hill.

Coleman, J. S., & Fararo, T. J. (1992). Rational choice theory. *Nueva York: Sage*.

Fama, E. F. (1965). The behavior of stock-market prices. *The journal of Business*, *38*(1), 34-105.

Fama, E. F. (1991). Efficient capital markets: II. *The journal of finance*, *46*(5), 1575-1617.

Fama, E. F., & French, K. R. (1995). Size and book-to-market factors in earnings and returns. *The journal of finance*, *50*(1), 131-155.

Fama, E. F., & French, K. R. (1998). Value versus growth: The international evidence. *The journal of finance*, *53*(6), 1975-1999.

Fama, French (1992): The Cross-Section of Expected Stock Returns

Gordon, M. J. (1959). Dividends, earnings, and stock prices. *The review of economics and statistics*, 99-105.

Graham, B. (1976). A conversation with Benjamin Graham. *Financial Analysts Journal*, *32*(5), 20-23.

Graham, B. (1976). A conversation with Benjamin Graham. Financial Analysts Journal, 32(5), 20-23.

Graham, B. (2005). *Intelligent Investor: The Classic Text on Value Investing*. Harper Collins.

Graham, B. (2009). *The Intelligent Investor, Rev*. Harper Collins.

Graham, B., & Dodd, D. L. (1934). *Security analysis: principles and technique*. McGraw-Hill.

Graham, B., Zweig, J., & Buffett, W. E. (2003). The Intelligent Investor: The definitive book on value investing. A book of practical counsel, revised edition.

Grinblatt, M., & Titman, S. (1989). Mutual fund performance: An analysis of quarterly portfolio holdings. *Journal of business*, 393-416.

Grinblatt, M., & Titman, S. (1993). Performance measurement without benchmarks: An examination of mutual fund returns. *Journal of business*, 47-68.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of finance*, *48*(1), 65-91.

Jegadeesh, N., & Titman, S. (2001). Profitability of momentum strategies: An evaluation of alternative explanations. *The Journal of Finance*, *56*(2), 699-720.

Johnson, R. R., Robinson, T. R., & Horan, S. M. (2014). Strategic value investing.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the econometric society*, 263-291.

Kobayashi-Solomon, Erik. *The Intelligent Option Investor: Applying Value Investing to the World of Options*. McGraw Hill Professional, 2015.

Koening, J. (1999). Behavioral finance: Examining thought processes for better investing. Trust & Investments, 69, 17-23.

Lakonishok, J., & Shapiro, A. C. (1986). Systematic risk, total risk and size as determinants of stock market returns. *Journal of Banking & Finance*, *10*(1), 115-132.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1992). The impact of institutional trading on stock prices. *Journal of financial economics*, *32*(1), 23-43.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. The journal of finance, 49(5), 1541-1578.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 13-37.

Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, *25*(2), 383-417.

Markowitz, H. (1952). Portfolio selection. *The journal of finance*, *7*(1), 77-91.

Markowitz, H. (1959). *Portfolio Selection, Efficent Diversification of Investments*. J. Wiley.

Montassér, R. D. (2000). *Technische Analyse verstehen: Ansätze, Methoden und Weiterentwicklung*. FinanzBuch-Verlag.

Montier, J. (2009). *Value investing: tools and techniques for intelligent investment*. John Wiley & Sons.

Montier, J. (2010). *Value investing: tools and techniques for intelligent investment*. John Wiley & Sons.

Murphy, J. J. (2000). Technische Analyse der Finanzmärkte. *Grundlagen, Methoden, Strategien, Anwendungen, München*.

Newton, I. (1999). *The Principia: mathematical principles of natural philosophy*. Univ of California Press.

Newton, I., Motte, A., & Chittenden, N. W. (1850). *Newton's principia: The mathematical principles of natural philosophy*. Geo. P. Putnam.

Norregard, Martin (2008). Momentum Investment Strategy – An empirical and explorative study on price momentum - *The Danish evidence*, Copenhagen Business School

Poterba, J. M., & Summers, L. H. (1988). Mean reversion in stock prices: Evidence and implications. *Journal of financial economics*, *22*(1), 27-59.

Reinganum, M. R. (1981). Misspecification of capital asset pricing: Empirical anomalies based on earnings' yields and market values. *Journal of financial Economics*, *9*(1), 19-46.

Rosenberg, B., Reid, K., & Lanstein, R. (1985). Persuasive evidence of market inefficiency. *The Journal of Portfolio Management*, *11*(3), 9-16.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, *19*(3), 425-442

Sharpe, W. F. (1966). Mutual fund performance. *The Journal of business*, *39*(1), 119-138.

Shefrin, H., & Statman, M. (1985). The disposition to sell winners too early and ride losers too long: Theory and evidence. The Journal of finance, 40(3), 777-790.

Shiller, R. J. (2003). From efficient markets theory to behavioral finance. *The Journal of Economic Perspectives*, *17*(1), 83-104.

Shleifer, Andrei. (2000). Inefficient markets: An Introduction to Behavioral Finance. New

Spierdijk, L., Bikker, J. A., & Van den Hoek, P. (2012). Mean reversion in international stock markets: an empirical analysis of the 20th century. *Journal of International Money and Finance*, *31*(2), 228-249.

Stattman, D. (1980). Book values and stock returns. *The Chicago MBA: A journal of selected papers*, *4*(1), 25-45.

Tversky, A., & Kahneman, D. (1975). Judgment under uncertainty: Heuristics and biases. In Utility, probability, and human decision making (pp. 141-162). Springer Netherlands.

York: Oxford University Press.