Value investing, quality investing or combining them all together? Empirical evidence from the Finnish Stock Market

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Title of thesis:
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Abstract:
The aim of the study is to compare value investing strategies against quality investing strategies in the Finnish stock market. In addition, the objective is to test, whether the combination of value investing and quality investing strategies yield superior results compared to the two as stand-alone strategies. Quality strategies used in this thesis are Grantham quality score, gross profitability and ROIC, while the value ratios that are in use are book to price (B/P) ratio, earnings to price (E/P) ratio, earnings before interest and taxes to enterprise value (EBIT/EV) and dividend to price (D/P) ratio. Combined quality and value portfolios are created based on combinations of quality – and value ratios.

As far as the author of this thesis is aware, only a handful of papers have investigated the performance of different quality investing strategies in the Finnish stock market. The lack of such studies motivated the author to explore the performance of different quality investing strategies in the Finnish stock market and compare them to more traditional value investing strategies. Additionally, the author of this thesis wants to study the combined performance of quality and value strategies as these strategies have not been studied in the Finnish stock market before.

The performance of these different portfolios was measured with two different risk-adjusted performance metrics, namely Sharpe ratio and Sortino ratio, and with two different asset pricing models, namely Carhart's four-factor model and Fama-French five-factor model. The results of this study contribute to the extensive literature review on the pricing models. In this study, the Fama-French five-factor model was more suitable than the Carhart's four-factor model as it had slightly higher explanatory power and the regression alphas were more statistically significant. The Fama-French five factor model is not widely used in this kind of studies.

The results of this study contribute also to the large literature stream for value- and quality premium to exist. In general, all the value-, quality- and combined quality and value portfolios, outperformed the overall market in the Finnish stock market. The most prominent investment strategies were achieved when Grantham quality score and combined quality and value portfolios were used as the criterion to form portfolios. Although the results of this study show a clear outperformance of all the three different strategies compared to overall market, the portfolios seemed to be highly correlated. There was no portfolio strategy that outperformed the other portfolio strategies year by year and the best performing portfolios were created based on an average of multiple measures. Lastly, this thesis took up the discussion around formulaic based investing and its drawbacks. Further research is needed on the topic.

Keywords:
Value investing, quality investing, combined quality and value investing, Sharpe ratio, Sortino ratio, Carhart's four-factor model, Fama-French five-factor model

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Värdeinvestering, kvalitetsinvestering eller kombination av värde- och kvalitetsinvestering? En empirisk studie på den finländska aktiemarknaden

Sammandrag:
Syftet med avhandlingen är att jämföra värdeinvesteringsstrategier med kvalitetsinvesteringsstrategier på den finländska aktiemarknaden. Dessutom är meningen med avhandlingen att testa om kombinationen av värde- och kvalitetsinvesteringsstrategier producerar överlägsna resultat jämfört med de två som fristående strategier. Kvalitetsstrategier som används i denna avhandling är bruttovinst, Granthams kvalitetsindikator och ROIC-tal medan värdeinvesteringsstrategier som används är B/P-tal, E/P-tal, EV/EBIT och D/P-tal. Kombination av värde- och kvalitetsportföljer är skapad baserat på kombinationer av värde- och kvalitetskvoter.

Såvitt som författaren av den här avhandlingen är medveten om har bara ett fåtal forskningar undersökt presterande av kvalitetsinvesteringsstrategier på den finländska marknaden. Brist på sådana studier motiverade författaren av denna avhandling att utforska det här ämnet och jämföra det med mer traditionella värdeinvesteringsstrategier. Därutöver studeras kombinationer av värde- och kvalitetsinvesteringsstrategier eftersom de här strategierna inte heller har undersökts förut på den finländska marknaden.

Presterande av de här olika portföljerna uppmättes med två olika riskjusterade avkastningsmått, nämligen med Sharpekvot och Sortinokvot, och med två olika prissättningsmodeller som är Carharts fyrafaktormodell och Fama-Frenchs femfaktormodell. Resultat från denna studie bidrar till den utförliga litteraturen för prissättningsmodeller. I den här forskningen var femfaktormodellen lämpligare än fyrafaktormodellen eftersom den här modellen hade lite högre förklaringsgrad och regressionsalfavärden. Däremot har femfaktormodellen inte använts så mycket i studier av detta slag.

Resultaten av den här studien medverkar också till den omfattande litteraturströmmen för värde- och kvalitetspremium att existera. Överlag har alla värde-, kvalitets- och kombination av värde- och kvalitetsinvesteringsstrategier överpresterat den generella finländska aktiemarknaden. Mest prominenta investeringsstrategier uppnåddes när Granthams kvalitetsindikator och kombination av värde- och kvalitetsinvesteringsstrategier användes som kriterium för att forma portföljer. Trots att resultaten visar en tydlig överprestation av alla tre olika strategier jämfört med den generella marknaden verkade alla portföljer vara högeligen korrelerade. Det fanns ingen portföljstrategi som överpresterade marknaden år efter år och de bästa presterande portföljerna bestod av ett medeltal multipla kvoter. Till sist tog den här avhandlingen upp diskussion kring formelbaserat investering och nackdelar med dem. Ytterligare forskning behövs kring ämnet.

Nyckelord: Värdeinvestering, kvalitetsinvestering, kombination av värde- och kvalitetsinvestering, Sharpekvot, Sortinokvot, Carharts fyrafaktormodell, Fama-Frenchs femfaktormodell

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1 INTRODUCTION

Value investing is one of the most debated investment strategies among equity investors worldwide. Value investing has often been considered one of the most popular investing strategies, driven by successful investors such as Warren Buffett, Seth Klarman and Joel Greenblatt. Value investing strategies have changed significantly over the years although the underlying concept has remained the same over the years. The key focus of a classic value investor is to buy stocks that are undervalued.

Graham and Dodd (1934) first introduced the concept of value investing in their book 'Security Analysis'. They recommended to move beyond the reliance on simple fundamental ratios to gain a better understanding of a security's true value. However, with the emerge of financial databases and computers, a reversion towards so called value ratios was made. A key contributor was the financial database developed by the Center for Research in Security Prices (CRSP) in year 1960. The CRSP database initially supported the view of efficient market (Fama, 1970) and by the 1980s, a large number of anomalies had emerged, including book to price ratios and earnings to price ratios. By the 1990s, the term value investing had been linked to investment strategies with simple ratios of accounting numbers and the era of formulaic based value investing had started.

Academic research has mainly focused on finding out multiples that are characterized by value stocks and finding out the source of the value premium (e.g. Fama and French 1992, 1996; Chan, Hamao and Lakonishok, 1991; Lakonishok, Schleifer and Visny, 1994). In addition, there have been multiple studies comparing value stocks with growth stocks; generally, value stocks have managed to outperform the growth stocks. While value stocks are known for investors trying to find stocks that are price lower to their fundamentals, growth stocks tend to have sustainable positive cash flows and earnings are expected to grow faster than comparable stocks within the same industry.

However, there might have been a shift from value stocks towards growth stocks in the past decade. A vast body of recent research has studied the performance of value stocks across various markets, with many reporting weakening successes of formulaic based value investing strategies (e.g. Asness, Frazzini, Israel and Moskowitz, 2015; Kok, Ribando and Sloan, 2017; Schwert, 2003). This has led researchers to find other strategies and a somewhat similar, but also clearly different strategy to value investing, which has gained significant attention in recent years, is quality investing, which focuses on stocks that are chosen based on fundamental "quality" characteristics.

Not as many researches have studied the performance of quality stocks and the definition of the concept has been somewhat unambiguous. Moreover, as far as the author of this thesis is aware, only a handful of papers have investigated the performance of quality investors in the Finnish stock market. The lack of such studies motivated the author to explore the performance of different quality investing strategies in the Finnish stock market and compare them to more traditional value investing strategies. In addition, the author of this thesis wants to study the combined performance of quality and value strategies as these strategies have not been studied in the Finnish stock market before.

1.1 Motivation for the topic

While there has been a strong case for a value premium to exist in the past, in recent years, value investing has seemingly lost its sparkle according to the news, especially in the U.S. For example, if you google the phrase "the death of value investing", you find a number of articles discussing this topic with controversial perspectives. Still, not much empirical evidence of growth stocks outperforming value stocks can be found in the finance-related literature, although in the U.S. it is clear that the growth stocks have outperformed the value stocks in the past decade (Carosa,2019).

While not as many studies have criticized value investing, a few critics already exist. For example, Kok, Ribando and Sloan (2017) criticized the term "value investing" as it is linked with strategies that use ratios of common fundamental metrics and that these metrics do not comprehensively determine the intrinsic value of the financial asset. The study also found out that there is only little evidence that value investing strategies produce superior results in the U.S. equities. Additionally, it should be noted that these strategies systematically identify firms that have inflated accounting numbers. Another similar study written by Lev and Srivastava (2019) concluded that based on their extensive data analysis, value investing has been unprofitable for almost 30 years in the U.S. equities. The reasons included systematic misidentifications in the accounting numbers and fundamental economic developments.

After the financial crisis, the general belief in the market has been that value stocks have been underperforming growth stocks in the U.S. (Li, 2019), caused by the long period of low interest rates. In 2008. The Federal Reserve started its quantitative easing program. The easier monetary policy has caused the stock valuations for growth stocks to increase while simultaneously, value stocks have been achieving smaller value premiums. In addition, new technology has disrupted economies by destroying value in some industries.

However, while there has been evidence of underperformance of value stocks in the U.S., the evidence is not that self-evident in other countries. It is interesting to see how the value investing strategies have been performing in the Nordic countries, namely in the Finnish stock market. There can be differences between U.S. stock markets and Finnish stock markets and that is why it is not that self-evident that there is underperformance of value stocks in the Finnish stock market. Pätäri and Leivo (2009) conclude that the Finnish stock market is interesting in the light of value investing because institutional investors cash their equity positions first from the farthest stock markets during uncertain times. This, together with the low liquidity within the Finnish stock market, leads to higher volatility which in turn could give rise to pricing errors causing the value premium.

Moreover, while value investing is widely researched topic, quality investing has received much less attention. Defining what quality investing is, has been somewhat challenging in the finance literature and there has been no clear concept of it. Some researchers define quality stocks based on financial indicators; others relate to it non-financial indicators. This thesis is inspired by Novy-Marx's (2014) definition of quality investing. He defines quality investing based on seven fundamental quality metrics and combines value investing with quality investing. As far as the author of the thesis is aware, quality investing in the Finnish stock market has not been studied before. It is also interesting to see how different value investing metrics and quality investing metrics have performed after the financial crisis.

1.2 Purpose of the study

The purpose of the study is to compare value investing strategies against quality investing strategies in the Finnish stock market. In addition, the objective is to test, whether the combination of value investing and quality investing strategies yield superior results compared to the two as stand-alone strategies.

The research questions could be phrased as follows:

i. Do value investing strategies outperform the quality investing strategies or vice versa?

ii. Does the combination of value investing and quality investing strategies yield superior results compared to the two as stand alone?

1.3 Contribution

One important question for the researcher is the choice of value- and quality metrics. There are numerous ways to categorize both value- and quality stocks. After a thorough examination of the available value- and quality metrics, the value ratios that are used in this thesis are book to price (B/P), earnings to price (E/P), earnings before interest and taxes to enterprise value (EBIT/EV) and dividend to price (D/P), while the quality ratios that are in use are gross profitability, ROIC and Grantham quality score. The combined quality and value ratios are created by putting creating equally weighted portfolios of value- and quality ratios.

Moreover, as far as the author of this thesis is aware, no previous studies regarding the quality aspects of stocks in the Finnish stock market have been done. Ratios relevant to the topic, such as gross profitability and Grantham's quality score, have not been widely studied in these stock markets either. In addition, combining value with quality in the Finnish stock market has not received much attention. Finally, this thesis is the first study to test the quality dimension in a smaller market sentiment.

The author was motivated to make these choices, thanks to several noteworthy sources. The value ratios were mainly inspired by Leivo and Pätäri's (2009) paper and Davodov, Tikkanen and Äijö's (2016) paper as E/P, EBIT/EV and D/P have been the best performing value multiples in the Finnish stock market, while B/P might be the most used value metric in the previous finance literature. Quality ratios have most noteworthily been inspired by authors Novy-Marx (2014) and Chakraborty's (2018), who have concluded in their research that gross profitability and Grantham's score have been the best performing quality strategies. Combining quality with value is also inspired by the two above quality investing papers and by "Magic Formula," proposed by Greenblatt (2006). Combining quality with value has not been widely studied across various stock markets.

Another important question for the author of this thesis is the choice of a suitable econometric model, as numerous risk-adjusted performance- and pricing models exist. After an extensive investigation of the previous models that have been used, Sharpe ratio and Sortino ratio were chosen to measure the risk-adjusted performance. Sharpe ratio was chosen because it is maybe the most famous risk-adjusted performance ratio.

However, it has received some criticism as it penalized for very high positive returns. That is why this thesis uses another risk-adjusted performance ratio, namely Sortino ratio, which correct for the drawdowns that the Sharpe ratio have.

The results of this study also contribute to the extensive literature review on the pricing models. This thesis applies two different asset pricing models, namely Carhart's four-factor model and Fama-French five-factor model. Carhart's four-factor model was chosen because many famous profitable trading strategies are based on the three basic underlying anomalies, which are size, value and momentum. Although Carhart's four-factor model is widely studied in the Finnish stock market, the Fama-French five-factor model has received lesser attention. That is why this model is applied in this thesis. It is of interest which of these two models have more explanatory power.

The results from these types of studies may have significant implications to several financial tasks, e.g., asset pricing, portfolio selection, risk management, and investment product creation. For investors, who are seeking to invest in the Finnish stock market, this study provides evidence on the performance of some fundamental value and quality indicators that can help predict long-term stock performance. The outcomes of the study may also help further categorize between underperforming stocks and outperforming stocks.

1.4 Limitations to the study

There are some limitations regarding this study. First, this thesis is only studying the Finnish stock market. Additionally, only the best performing value investing strategies and quality investing strategies are examined. The value investing ratios that are examined are B/P, E/P, EBIT/EV and D/P. The quality ratios that are examined are ROIC, gross profitability and Grantham's quality score. These are chosen based on previous research.

This thesis is also concentrating on simple value – and quality metrics and no binary variables are used to construct portfolios. This thesis will not take stand on what is the exact composition of different value-, quality- and combined quality and value portfolios. Additionally, this study is limited to financial indicators and non-financial indicators are excluded from the sample.

Financial variables and historical stock prices are obtained from Thomson Reuters database. Only the companies that have both financial variables and historical stock prices are included in the sample. Market index used in this thesis is the OMX Helsinki Cap GI index and it is retrieved from Nasdaq OMX Nordic's website. In this website, the market index data is only available from 1.6.2011 onwards and that is why the chosen time period is from 1.6.2011 to 1.2.2020. The time after financial crises is also of special interest. Moreover, the factor data for the factor models were obtained from the Kenneth French online library, while the factors used for this thesis were readily available European factors. Finally, this thesis did not include transaction costs.

1.5 Composition

The thesis is structured as follows: chapter 2 covers financial theory around value- and quality investing. Chapters 3, 4 and 5 continues by defining value investing. quality investing and combined quality and value investing and how these different strategies have performed in the past. Chapter 6 is discussing the most relevant previous studies more precisely and summarizes the key findings. The empirical part of the thesis is introduced in chapters 7 and 8, where the data section is covered, and the methodology part reviewed. The results of the conducted empirical study are presented and discussed in chapter 9. In chapter 10, the key findings are discussed. Finally, the concluding remarks regarding the research topic are presented in chapter 11.

2 FINANCIAL THEORY AROUND VALUE INVESTING AND QUALITY INVESTING

In this chapter, financial theory around value investing and quality investing is discussed. First, the efficient market hypothesis (EMH) is covered. Second, the criticism regarding the efficient market hypothesis is discussed. The EMH theory and its criticism is included here, because the author of this thesis wanted to find out, how the contradicting theory applies to value investing and quality investing. Third, the modern portfolio theory proposed by Markowitz (1952) is introduced. This theory is included here because it is the base for the entire asset pricing theory. The most popular risk-adjusted performance ratios are also reviewed. The risk-adjusted performance ratios are discussed here, too. Later in the methodology part, the chosen risk-adjusted performance ratios are presented in more depth. Lastly, the history of asset pricing models is discussed. In the methodology part, the chosen asset pricing model is more carefully examined.

2.1 Efficient market hypothesis

Fama (1970) studied the theory of efficient markets in-depth. Efficient market hypothesis (EMH) states that financial market is efficient in a sense that all market prices "fully reflect" all available information. This assumption is based on conditions of market equilibrium that can be expressed in terms of expected returns. In the long run, average investors are not able to "beat the market" as the competition among investors eliminates arbitrage opportunities. Passive investing is based on this view and this strategy tracks a market-weighted index or portfolio.

Efficient market hypothesis can be divided in three categories: strong-form, semi-strong-form and weak-form tests. Strong-form tests whether investors have private information, semi-strong tests the publicly available information and the weak-form tests information contained in historical prices. If financial markets are in weak form, it is not possible to earn abnormal returns by analyzing historical time series or by trying to outperform the markets. For example, Fama (1970) show that daily prices are unpredictable, although the prices are followed by large changes. Semi-strong form has been supported by the efficient market hypothesis; for instance, Fama, Fisher, Jensen and Roll (1969) find that information concerning firm's future dividend payments are on average "fully reflected" in the market price, when the stock splits. In addition, there is also evidence of strong-form efficiency as Scholes (1969) showed that while corporate insiders have monopolistic access to information, it could not be shown that there is evidence against the theory of efficient market hypothesis.

Random walk theory is closely related to efficient market hypothesis. Malkiel (1973) showed that market prices are random and unpredictable and cannot be examined by analyzing historical data. According to this theory, there is no point of doing technical or fundamental analysis. There are two variants of random walk theory: semi-strong form and strong form. In semi-strong form, public information does not help investors to find undervalued securities as they have already been reflected in the current market price. On the other hand, strong form of random walk theory states that neither public nor private information would help the investor to analyze the stock prices given that all information is reflected on the current stock price.

2.2 Criticism against the efficient market hypothesis

Efficient market hypothesis has also received significant criticism. A famous "Wall Street phrase" is that "the most valuable commodity is information." Moreover, it is expensive to unveil and analyze this information and investors are demanding higher rewards for higher risk expectations. Grossman and Stiglitz (1980) found out that if markets are in equilibrium, it is rewarding to collect information. Additionally, they concluded that the markets are not always efficient and that it varies in different markets. This is the starting point for active investing, which tries to seek alpha returns by finding mispriced securities. Value investors believe that stock selection does matter, and that the theory of efficient markets can sometimes be rejected. Markets are mispriced, and it is possible to find positive alpha values, meaning that active investors are capable of outperforming markets in the long run.

In the 21st century, more and more financial economists and statisticians have started to believe that prices of market securities are partially predictable and Fama's theory regarding efficiency of markets are not completely true. For example, some people have started to highlight psychological and behavioral aspects of how the market prices behave. For example, Thaler (1993) and Shiller (2000) concluded that crowd psychology and behavior psychology has major effects on market prices and that market prices are not as efficient as the common thought. In addition, Malkiel (2003) studied the efficient market hypothesis and concluded that market anomalies still exist and there is evidence of market prices being somewhat predictable. Markets are not always correctly priced as investors are doing some irrational decisions. Financial markets are not perfect as otherwise there would be no space for professional portfolio managers to reveal information.

A study regarding value investing would be somewhat incomplete without discussing the abnormal returns of the great names, such as Warren Buffett, Joel Greenblatt and Seth Klarman, in more detail. These investors have put their names to the history books by outperforming the markets year after year. This should not be possible if the markets were completely efficient. However, Yen and Lee (2008) believe that the results can be explained by how rational investors correct the mistakes made by irrational investors that have made bad decisions and this is kind of a magnitude issue. Other issues that concerns the efficient market hypothesis is the selection bias issue, in which the failed outcomes are more often preselected to be presented and the lucky event issue, in which it can be pure luck that you have managed to outperform the market (Bodie, Kane and Marcus,2014, pp 362-364).

2.2.1 Contradicting litterature against EMH: evidence from weak-form, semi-srong-form and strong-form

Testing weak form of efficient market hypothesis is done by finding patterns in the stock returns. This can be done by measuring serial correlation in the stock prices. Serial correlation is the tendency for stock returns to be related to past returns. For example, Jegadeesh and Titman (1993) discovered that recent performance of a stock tends to continue over time, which is called momentum effect. On the other hand, Chopra, Lakonishok and Ritter (1992) and Debondt and Thaler (1995) found that poorly performing stocks in one period can experience reversals in the following periods. Reversal effect simply suggests that stock markets often overreact to relevant news.

There have been multiple studies testing the semi-strong form of market efficiency by investigating the fundamental analysis and asking if the investment performance can be improved by using publicly available information (Bodie, Kane and Marcus,2014, pp 366-370). Surprisingly, many studies contradict the efficient market hypothesis and these findings have been referred as market anomalies. For instance, anomalies such as small-firm-in January effect, book-to-market and price to earnings are popular findings in the finance literature. In chapters 3.2 and 4.2, the market anomalies in value investing and quality investing are looked more closely.

Markets are not expected to be of strong form as otherwise it would be no surprise that insiders are able to earn superior yields. Insider information is prohibited by law.

However, Jaffe (1974), Givoly and Palmen (1985) have been able to find tendencies for stocks to rise after insiders have bought them excessively and vice versa. All in all, the anomalies find in the finance literature are extensive. We are looking more closely on the chapter 3.5, whether the anomalies can be interpreted as risk premiums or inefficiencies?

2.3 Modern portfolio theory

Modern portfolio theory was developed by Harry Markowitz (1952). The theory is based on how risk-averse investor can construct a portfolio of multiple assets that will maximize the returns for a given level of risk or a given level of expected returns, while the portfolio is constructed with lowest possible risk. A risk-averse investor prefers a less risky portfolio to a riskier one given level of return. Returns are measured with means and risks with variances.

Correlation is measuring the degree to which two securities move in relation to one another (Markowitz, 1952). In portfolio theory, the values lie between one and minus one. If the securities are not perfectly correlated, diversification will be beneficial. The lower the correlation between two assets, the higher the diversification benefits. Diversification reduces risk by allocating financial securities among different asset classes, categories and industries. Two types of risks exist: systematic risk and unsystematic risk. While systematic risk is undiversifiable as it affects the whole market (e.g. inflation, exchange rates, interest rates and political instability), unsystematic risk only affects specific companies or industries; therefore, the risk can be reduced by investing in different financial securities.

After finding out all the possible combinations of risk and return alternatives, the next step is to allocate the assets based on investor preference (Markowitz, 1952). Individual investors allocate their portfolios between the risky assets and the risk-free assets. Optimal portfolio lies in the efficient frontier, meaning that the set of optimal portfolios exist that offer the best risk-return combinations. Then the optimal portfolio is constructed by identifying portfolio weights that result in the steepest capital allocation line while lying on the efficient frontier. Capital allocation line is a graph measuring the risk of risk-free assets and risky assets. When analyzing assets using means and variances, the tangency portfolio is the portfolio with highest Sharpe ratio, which is a common measure of risk-adjusted performance.

2.3.1 Risk-adjusted performance

There are several risk-adjusted return ratios to evaluate the performance of portfolios. The most common risk-adjusted performance ratio is the Sharpe ratio developed by William Sharpe (1966). The difference of the expected portfolio return and risk-free rate and (excess return) are divided by standard deviation, which is a measure of volatility. Treynor (1965) proposed a similar metric but instead of using standard deviation as a risk measure, the beta coefficient is used. The beta coefficient is measuring the sensitivity of a security to movements in the whole market. Jensen's Alpha (1968) is measuring the performance of an expected portfolio return against the returns predicted by the capital asset pricing model (CAPM).

In addition, some other popular risk-adjusted performance ratios are Sortino's ratio (1994) and Modigliani-Modigliani ratio (1997). Sortino's ratio is a modified version of the Sharpe ratio, but it also considers the downside risk. It will penalize those returns that are falling below a pre-determined target. Modigliani-Modigliani ratio is also an extended version of the Sharpe ratio, where the risk-adjusted return of the portfolio is given by multiplying the Sharpe ratio with standard deviation with any benchmarked index and then adding the risk-free return to it. Additionally, information ratio is a popular risk-adjusted performance ratio. Alpha is divided by the nonsystematic risk, which is called "tracking error" (Bodie, Kane and Marcus, 2014, pp 274-276). Information ratio measures the excess return per unit of risk that could be diversified away by holding a market portfolio.

2.3.2 Pricing securities in an efficient market

If financial markets are efficient, the remaining key question is how the financial assets are priced? The first and maybe the most famous pricing model in finance is the capital asset pricing model (CAPM) proposed by Sharpe (1964), Lintner (1965) and Mossin (1966).

Assuming that the portfolios are created by using the Markowitz (1952) portfolio selection style, the CAPM model predicts the relationship between the risk of a financial asset and its expected return. CAPM assumes that investors seek for mean-variance optimal portfolios and are single-period planners. In addition, financial markets should be frictionless (e.g. no taxes or transaction costs), investors are price-takers, all risky assets are publicly traded, and investors can buy and lend at a fixed risk-free rate. If all these conditions uphold, the CAPM implies that in a market equilibrium, the market portfolio is the unique mean-variance efficient tangency portfolio. All in all, if CAPM is a valid model, the intercept estimate should be close to a risk-free rate, the slope should be close to the market premium, there is a linear relationship between a stock's return and beta, while no other variables should help explain the cross-sectional returns.

The CAPM model has received criticism as well. For example, it has been found that the returns in the CAPM model are systematically higher for small market capitalization stocks than for high market capitalization stocks. The previous literature has also found that value stocks (in this case low-market-to-book-ratios or price-to earnings ratios) have higher returns than what the CAPM would predict. In addition, Fama and Macbeth (1973) tested CAPM with a two-stage approach that used a time series of a cross sections approach. This study found that while there is some qualitative support for CAPM to hold, there is no quantitative support as the intercept and the slope are not of appropriate size and the results are not statistically significant.

While CAPM is a single-factor model, there have been many extensions of it (Bodie, Kane & Marcus,2014, pp 291-302). Multifactor models seek to enhance the explanatory power of the CAPM model by including a variety of systematic components of security risk. These models try to capture a wide range of macroeconomic risk factors. Arbitrage pricing theory (APT) is closely related to asset pricing theory and it is derived from a factor model by using arbitrage and diversification arguments. The APT states that there are no risk-free arbitrage opportunities.

Fama and French (1992) were first to introduce the size and value factors, while Fama and French (1993) used a factor-based model with the size and value factors. Carhart (1997) extended the factor model by including an additional momentum factor. Chen et al. (2010) introduced a new three-factor model that combined return on equity (ROE) factor with the three-factor model. Fama and French (2015) proposed a five-factor model that uses size, value, profitability and investment factors. Asness et al. (2018) introduced a new quality factor, namely quality-minus-junk factor, which consists of safe, profitable and growing companies that can account for why firms earn abnormal returns. Lastly, Frazzini, Kabiller, and Pedersen (2018) showed that by including a betting-against-beta factor and a quality-minus-junk factor, Buffett's alpha becomes insignificant. All in all, the excess returns earned by Berkshire Hathaway can be explained by Buffett's preference for high-quality stocks.

3 VALUE INVESTING

In the next section, we are going to go through what is the history of value investing and how it has developed. Secondly, this thesis will go through what is the literature review around value investing strategies that used historical multiples to reveal if there exist market anomalies. Thirdly, the advantages and disadvantages of the value investing strategies that used historical multiples, are discussed shortly. Fourthly, the criticism regarding value multiples are discussed. Fifthly, what causes the value premium to exist is presented. Finally, a summary of this section is made.

3.1 A brief history of value investing

It all started when Graham and Dodd (1934) published a booked called Security Analysis. Graham and Dodd (1934) recommended to move beyond simple fundamental metrics to gain more complete understanding of the underlying securities true value and find securities that are underpriced. They further mention that simple fundamental metrics are not enough for analyst to base their decision on and that further research is needed in order to provide a rational basis for investment decisions.

Value investing in the Graham's and Dodd's era lies on four main principles. The first one is that many of the financial securities have some underlying fundamental economic value that are relatively stable and can be measured quite precisely (Graham and Dodd, 1934). Therefore, the intrinsic value of the financial security can be something else than the current market price. The intrinsic value can be justified for example with dividends, earnings, assets, and future prospects.

Margin of safety is a key concept in value investing (Graham and Dodd, 1934). Margin of safety is the gap between the stock's intrinsic value and the current price. The lower the price of the security relative to its intrinsic value, the higher the margin of safety. Mr market views the market prices as if he or she would be in business with a manic-depressive partner. The manic-depressive partner repeatedly offers to sell or buy securities based on his mental state. The decisions can range from wildly optimistic to highly pessimistic. Lastly, the final concept in the Graham and Dodd era is the diversification principle. For risk purposes, the securities portfolio should consist of multiple stocks.

For the next 50 or so years, the approach to value investing prevailed with different modifications of it. During 1980s, the general view on value investing changed, when the rise of pricing multiples began to gain attraction through the rise of computers, financial databases and awareness of market anomalies. A key contributor was the financial database developed by the Center for Research in Security Prices (CRSP) in year 1960. The CRSP database initially supported the view of efficient market (Fama, 1970) and by the 1980s, a large number of anomalies have been emerged, including different value investing multiples, such as the price to earnings ratio, cash-flow-to price ratio and book to price ratio. By the 1990s, the term value investing had been linked with investment strategies that used simple ratios of accounting numbers and the era of formulaic based value investing had begun, followed by e.g. Fama and French, who reported significant relationships between future stock returns and value ratios. However, in recent years a body of recent research has studied the formulaic based value investing across various markets and come to the conclusion that there are weakening successes of formulaic based value investing strategies (e.g. Asness, Frazzini, Israel and Moskowitz, 2015; Kok, Ribando and Sloan, 2017; Lev and Srivastava,2019).

3.2 Value investing strategies using historical multiples

Previous literature has a built strong case for value premium to exist. Basu (1977) was the first researcher to find out that value stocks outperform the market by looking at the price to earnings ratio (P/E). Low P/E stocks performed better than the high P/E stocks in the U.S. stock market between years 1956 and 1971. Fama and French (1993) were the forerunners in presenting the three-factor model, which has revolutionized the whole asset pricing theory. Three factor model examined the returns from low book to price (B/P) and the high book to prices (B/P) and concluded that low B/P stocks performed better than the high B/P stocks. Generally, low B/P stocks have been considered as value stocks while high B/P stocks have been considered as growth stocks.

Chan, Hamao and Lakonishok (1991) studied cash-flow-to-price (CF/P), book to price (B/P) and earnings to price (E/P) ratios in the Japanese market and came to the conclusion that these strategies could potentially earn excess returns. Suzuki's (1998) study showed extraordinary performance of sales-to-price (S/P) in Japanese market during years 1983-1996. Fama and French (1992,1996) and Lakonishok, Schleifer and Visny (1994) found out that a strong value premium exists in the U.S. stock market, while high CF/P, B/P and E/P stocks earn higher average returns in the U.S. than low CF/P, B/P and E/P stocks.

Moreover, Fama and French (1995) and Lakonishik et al. (1994) noted that the value premium is related to financial distress. In addition, Fama and French (1998) compare value premiums in thirteen major stock markets between years 1975-1995 by constructing portfolios based on B/P, E/P, CF/P and dividend yield (D/P). The highest value premium was found to be statistically significant with CF/P in Australia, Italy, Hongkong and Germany. B/P criterion had the most significant value premium in Belgium, Japan, Singapore, Switzerland, UK and USA. E/P criterion resulted in highest value premium in Sweden and the Netherlands. The D/P criterion had highest value premium only in France.

Additionally, Larkin (2009) studied growth at reasonable price (GAPR) strategies with one and two-factor models and value investment strategies against a market portfolio in the U.S. between years 1998 and 2006. The best performing strategies were EBIT/EV and combined strategies with multiples EBIT/EV and E/P. Furthermore, An, Cheh and Kim (2017) compare the performance of value stocks and growth stocks in the U.S. between years 1999 and 2014 using the enterprise value (EV). The performance was measured with ratio EBIT/EV. The results indicate that value stocks outperformed the growth stocks.

Pätäri & Leivo (2009) studied the performance of value strategies in the Finnish stock markets by dividing six value ratios (i.e., B/P, CF/P, E/P, EBITDA/EV, D/P and S/P) into three portfolios and eight composite measures. All value investing strategies give a strong case for the value premium to exist in the Finnish stock market, too. However, the best performing value strategy was D/P, while the P/E strategy performed well too, though not being statistically significant. By combining strategies together, even better results can be yielded. By combining D/P, EBITDA/EV and B/P, the highest alpha is achieved. According to the study, there is also a strong case for the EBITDA/EV multiple.

Additionally, Pätäri and Leivo (2015) concluded that portfolios based on traditional value investment strategies vary over time and across markets. Lastly, Davydov, Tikkanen & Äijö (2016) studied the Magic Formula proposed by Greenblatt (2006, 2010) and other traditional value investing strategies B/P, CF/P, E/P and EBIT/EV and concluded that the best performing strategies in the Finnish stock market during years 1991-2013 were EBIT/EV and E/P.

3.3 Advantages and disadvantages with the value investing multiples

Price-to-earnings ratio (P/E) compares the market value of a security to its earnings. The ratio tells what is the market's willingness to pay today for a stock based on its future and past earnings (Bodie, Kane and Marcus, 2014, pp 652). Low P/E ratio allows the investor to pay less per dollar of current earnings whereas the high P/E ratio is indicating that the investor have to pay more per dollar of current earnings. Low P/E stocks can be considered as value stocks while the high P/E stocks can be seen as growth stocks. The limitations with this measure are that a company's earnings are based on historical earnings or future earnings, which in turn are based on the market's opinion.

The book-to-price ratio equals the market price of a share of the firm's common stock divided by its book value (Bodie, Kane and Marcus, 2014, pp 652). Low P/B ratio firms can be seen as "safer investment" because the B/P ratio can be seen as a "floor" supporting the market price. The B/P ratio can be seen as the level below which market price will not fall because the firm has always the option to sell or liquidate their assets. In general, P/B ratio below one would indicate that the stock could be potentially undervalued. There are some limitations regarding this measure as well. A low P/B value can indicate that a company is facing serious financial problems. This measure does not take into account if the company pays dividends or not and the measure do not take into account recent write-offs, share buy-backs or acquisitions and in that the sense this measure can have some distortions. Generally, P/B ratio does not work well for companies with high levels of intangibles and low levels of fixed assets.

Price to cash flow ratio (P/CF) measured the value of the stock price to operating cash flow per share. This measure is beneficial for valuing stocks that have positive cash flows but are not yet profitable because of large non-cash charges (Bodie, Kane and Marcus, 2014, pp 616). Compared to P/E ratio, it has been said that P/CF is said to better because it is not that easily manipulated.

Price to sales ratio (P/S) tells how much market price is related to companies' sales (Bodie, Kane and Marcus, 2014, pp 616). The multiple can help you to determine if the stock is properly valued and this ratio can be effective to capture growth stocks that do not yet have turn profitable and have suffered a temporary setback.

Dividend to price ratio shoes how much a company pays out in the form of dividends in relation to its market price (McDonald, 2017). The advantages with the D/P ratio are that the cash is actually paid out in dividends and the company is actually making money, this ratio is less volatile because the companies paying dividends are usually more stable, mature and these companies are regular dividend payers.

EV to EBIT ratio is a similar to ratio to EV to EBITDA ratio but it excludes depreciation and appreciation (Chan and Lui, 2011). EBIT is standing for earnings before interest and taxes and it is used to measure the company's performance without the costs of the capital structure and tax expenses. Enterprise value is to measure the company's total value. EV to EBIT is often used to reflect a company's true financial strength whereas the EBITDA to EV can give better guidance on profit growth and future sustainability as the depreciation and amortization is included. Though the drawbacks with this multiple is that not all companies are required to report their capital expenditures frequently and that EBITDA numbers can be misleading in that sense that some companies exclude important expenses in their reporting, such as research and development expenses.

3.4 Criticism of value investing

While not as many studies have criticized value investing, a few critics already exist. For example, Asness, Frazzini, Israel and Moskowitz (2015) identified a number of facts and fictions about value investing that needed clarification. Asness et al. stated as a fact, for example, that value can be measured in many ways, and it is best measured by a composite of variables. For example, Asness et al. (2015) stated that by looking at different measures of value (B/P, E/P CF/P and D/P) in each decade, there are times when all value measures do better or worse. However, the bottom line is that whichever way you identify value, cheap assets perform better than expensive ones. No single measure of value is verifiably outperforming the others, but an average of multiple ratios is typically best. The fictions that Asness et al (2015) tried to explain are the false notion that value investing is only effective in concentrated portfolios, value is solely compensation for risk and that a value premium in the future can only be consistent with a risk-based efficient view of the world.

Kok, Ribando and Sloan (2017) criticized the term "value investing" as it is linked with strategies that use ratios of common fundamental metrics (e.g., B/P and E/P) and that these metrics do not comprehensively determine the intrinsic value of the financial asset. The study also found out that there is only little evidence that these simple metrics B/P and E/P produce superior results in the U.S. equities. Additionally, it should be noted that these strategies systematically identify firms that have inflated accounting numbers.

The inflated accounting numbers are based on the fact that past E/P ratios identifies stocks that have currently high values but later on the values decline, while the future E/P ratios identifies stocks that have been recommended by sell-side analysts who offer more optimistic forecasts of the future earnings (Kok, Ribando and Sloan, 2017). B/P ratio identifies stocks that have overstated book values and in the future the values are written down. In order to help detect these distortions, these "value investment" strategies could be combined with some profitability, momentum and quality measures.

Another similar study written by Lev and Srivastava (2019) studied the price to book (P/B) ratio and price to earnings (P/E) ratio and concluded that based on their extensive data analysis, value investing has been unprofitable for almost 30 years in the U.S, while the dot-com bubble gave some additional boost to it. The reasons included systematic misidentifications in the accounting numbers, namely in the accounting for intangibles and the fundamental economic developments, which have caused the value stocks to underperform the growth stocks. The slowdown of mean reversion in value investing started during financial crisis in 2007. Definition of mean reversion is that over a certain time period, the securities' price tends to move towards its long-term average. Explanation for the poorly performing value stocks have included the dramatically declined bank lending during the financial crisis, which caused banks to have decreased lending permanently, while the consumer demand has also been decreasing. Since the financial crisis, value firms have experienced operational difficulties and their profitability has surged.

On the contrary, Schwert (2003) showed that many of the well-known anomalies do not hold in different samples, when modelled in asset pricing. For example, the weekend effect, dividend yield effect, small firm-turn of the year effect and stock market returns predictability with variables such as dividend yield or inflation rate, have all experienced fading anomalies. In a similar fashion, Linnainmaa and Roberts (2018) conclude that most accounting-based return anomalies are most likely a result of data snooping. Their sample results showed that average returns and Sharpe ratios of most anomalies decrease, while at the same time volatilities and correlations increase with other anomalies. All in all, value premiums are low and statistically insignificant.

Fama and French (2019) concluded that value premiums (low book to market ratios) in the U.S.A. were on average much lower, when compared to out-of-sample results, which are in between years 1963-2019 to in-sample returns from years 1963 to 1991. The value premium has declined from 0,36% per month to 0,05% per month. High volatility of monthly premiums prevents rejecting that premiums are the same in the in-sample and out-of-sample periods.

3.5 What causes value premium to exist?

For many years, there has been evidence of value strategies outperforming growth strategies. However, there have been mixed reviews upon what causes the value premium to exist. Fama and French (1993) argued that these findings can be explained by the risk premiums. Stocks with higher betas (factor loadings) on market to book ratios or size have on average higher risk premiums. This three-factor model is the simplest factor-based model, but the factor models can be extended by introducing more variables.

The opposite explanation for what causes the value premium to exist is given by Lakoniskok, Schleifer and Visny (1994) and their opinion, based on markets not being efficient enough. According to their findings, stock analysts make systematic errors in their forecasts, while analysts "extrapolate" past performance too far into the future. Good performance is overpriced, while bad performance is underpriced. When markets notice this, the performance turns upside down. La Porta (1996) agreed with Lakonishok et al.'s (1994) view and concluded that firms with lower expected growth rates perform better and vice versa.

3.6 Summary of value investing

In table 1, the summary of value investing is made.

Table 1: Summary of value investing

Value investing in the Graham and Dodd era	Value investing in the academic literature	Popular value investing ratios	Criticism of value investing	What causes the value premium to exist?
Graham and Dodd (1934) recommended to move beyond simple fundamental metrics to gain a more complete understanding of the underlying securities true value	In the 1980s the view on value investing changed, when through the rise of computers and financial databases, the awareness of market anomalies began to gain attraction	Price-to-earnings ratio, price-to-book ratio, price-to-cash-flow ratio, price-to-sales, dividend-to-price EBIT to EV and EBITDA to EV	Value investing is linked with ratios that use common fundamental metrics There can be systemic misidentifications in the accounting numbers Excess returns may have been due to fundamental economic development No single measure of value is demonstrably outperforming the others, but an average of multiple ratios is typically best	Risk premiums
Key concepts: intrinsic value, margin of safety, Mr Market, and diversification	Value investing has been related to simple ratios of accounting numbers in the academic literature	In general, these metrics have been managing to outperform the markets	data snooping could be related to many accounting-based returns anomalies Value premiums have been declined during years	Markets are not being efficient enough

4 QUALITY INVESTING

Quality investing dates to the 1930s when Benjamin Graham (1934) took a closer look to find out what characterizes quality stocks. He divided stocks into high quality and low-quality stocks and distinguished between buying cheap stocks or buying quality stock. Still, the concept of quality investing has not been well-specified as there has been no clear definition what quality investing is. For instance, it has been stated that "you know it when you see it" what quality stocks are. While some researchers define quality stocks based on financial indicators, others relate "quality" to non-financial indicators such as to sustainable practices.

This thesis is inspired by Novy-Marx's (2014) definition of what quality stocks are. In addition, this thesis is also inspired by findings made by Lalwani and Chakraborty's (2018), who extended the Marx's definition of quality stocks into the Indian stock market. First, the different definitions of quality investing are investigated. Second, the definition of what quality investing is, according to Novy-Marx, is examined more closely. The composition of these seven quality investing strategies are revealed and the justifications why these specific ratios are chosen as quality strategies are given. Third, the performance of the different quality investing strategies is revealed. Lastly, a summary of this section is made.

4.1 How to define quality investing?

There have been several definitions of what quality investing is. Damodaran (2004) stated that as an example, investors can link corporate governance, credit ratings, ethical issues or financial strength into quality investing. Some researchers say that quality is measured in the form of high ROE, stable earnings and low debt (Grantham, 2004). Quality can be stated also as "the opposite of junk", meaning that balance sheet is not consisting of high leverage, there is no cyclical profitability and the earnings are not irregular (Piotroski, 2000). Some investors explicitly look at the ESG criteria. While there have been numerous definitions of quality investing, we will use the definition suggested by Marx (2014).

4.2 What is quality investing according to Novy-Marx?

Novy-Marx (2014) defines quality investing as:

“Quality can even be viewed as an alternative implementation of value—buying high quality assets without paying premium prices is just as much value investing as buying average quality assets at a discount. “

While traditional value strategies are trying to buy assets cheaply, quality strategies try to buy uncommonly productive assets. While quality strategies tend to be expensive, the value investing strategies are of low quality. The seven fundamental quality metrics that Marx chose as quality metrics were Graham G-score, gross profitability, Sloan’s accruals, Grantham quality score, Greenblatt’s ROIC, Piotroski’s F-score and defensive equity strategies.

4.2.1 Novy-Marx’s seven quality measures

According to Novy-Marx (2013), gross profitability has the same explanatory power as the traditional value investing strategies. Gross profitability is defined as revenue minus total cost of goods sold, scaled by total assets. The insight in this multiple is that there is no need to go further down the income statement as the lower numbers can get manipulated by using accounting tricks.

Grantham (2004) defines quality companies as companies that have low earnings volatility, low leverage and high profitability. Grantham quality score is calculated by averaging the ranks of returns on the equity (ROE), inverse of ROE volatility and assets-to-book. ROE is the net income divided by the book-value of shareholder’s equity. ROE volatility is measured with standard deviation of the ROE in the past five years.

Greenblatt (2006) proposed a magic formula in his book “Little Book That Beats the Market”. The formula consists of the earnings yield measured as EBIT/EV and return on invested capital (ROIC). While the EBIT to EV ratio is a value metrics, the ROIC is a quality metric and used here as one of the quality strategies. ROIC (e.g. return on invested capital) is a measure of profitability that tells how much in percentages a company earns on invested capital. In other words, it measures how effectively a company turns capital into profits.

Graham G-score is a modified version of the original version of the Graham’s quality indicator (Novy-Marx,2014). It consists of five variables and it is measured from one to five scale. You get points if current assets exceed twice the current liabilities, net earnings have been positive for the past ten years, current assets exceed long term debt, current earnings per share are at least 33% higher than ten years and if dividends plus buy-backs have been positive in the past ten years. The higher the score, the higher the ranking.

Accruals refers to adjustments that need to be done before company's financial statements are published. Accruals are either revenues that have been not yet received but not have been recorded in the accounts, or expenses that have been incurred but not yet recorded in the accounts. Sloan (1996) developed a quality measure that takes the difference between cash and accounting earnings and scales it by firm assets. In more detail, Sloan's accruals method is measured as yearly change in current assets, excluding cash and short-term liabilities and then minus the long-term liabilities, not including current liabilities and income tax payables minus amortization and depreciation. After that, accruals are divided by the average of total assets.

Piotroski (2000) developed an accounting-based measure that is accounting for quality. Piotroski's score is consisting of nine binary variables and each component either indicates a weakness or a strength. Then the portfolios are constructed based on which companies have the highest F-score ranking. Four variables are used to account for profitability. The variables are return on assets (ROA), change in the ROA, cash-flow from operations (CFO) and accruals and earnings before extraordinary items. Three variables are constructed to measure the liquidity of a firm. The variables are changes in the firm's long-term debt levels, the change in the firm's current ratio and issuance of equity. The last two variables measure operating efficiency in the firm's operations. Margin is defined as firm's current gross margin ratio, which is measured as gross margin divided by total sales. The other efficiency measure is turnover ratio and it is calculated by total sales divided by the beginning of the year total assets.

Defensive equity strategies claim that the returns are much like equity returns, but only with smaller downside risk; therefore, these strategies are less volatile (Novy-Marx, 2014). These strategies are constructed by holding companies that have low beta values and low volatility.

4.2.2 Why the seven fundamental quality metrics were chosen?

Novy-Marx (2014) picked seven quality measures for his study. Generally, these seven quality strategies were chosen, because these strategies are widely used to account for quality in financial markets. Graham's quality criteria in the book "Intelligent investor" was chosen as it was the first attempt to distinguish quality and value stocks from each other. Grantham's quality score, which is known for "high return, stable return and low debt", have changed the outlook for the MSCI quality indices. Societe General uses Piotroski's F-score as a screening tool when constructing its Global Quality Index. Sloan's accruals method is used, when incorporating earnings quality into global equity strategies. For example, Blackrock, the largest asset manager in the world, uses this strategy. Greenblatt's ROIC has encouraged investors to pay attention to capital productivity. Gross profitability is chosen as a simpler quality measure as it has as much explanatory power predicting stock returns as any other traditional value multiple. Lastly, the defensive equity strategies are chosen here, as they have some of the same characteristics as quality stocks.

4.3 Performance of different quality investing strategies

In this section, the performance of different quality strategies is examined. This thesis has divided quality investing strategies in three categories: combining quality with Novy-Marx's seven fundamental quality criterions, combining quality investing with profitability and combining responsible investing with quality.

4.3.1 Combining quality with Novy-Marx

Novy-Marx empirically tested the performance of the seven fundamental quality strategies. All quality strategies yield some abnormal returns, although gross profitability generates only statistically significant excess returns. Grantham quality score also produces some promising results when looking at the spanning tests. Lastly, combining quality with value results in a better risk-return relationship.

Hanson and Dhanuka (2015) studied the seven fundamental quality metrics. The study concluded that out of all metrics, only the ROIC produced statistically significant outperforming results. In addition, they highlighted that investors, who focus on the long run, may earn abnormal returns, as usually investors tend to undervalue intangible assets such patent citations, R & D spending and advertising.

Lalwani and Chakraborty (2018) studied the performance of four quality indicators, namely magic formula, Piotroski's F-score, gross profitability and Grantham's quality score, compared to the overall market in India between years 2001 and 2016. Findings suggest that gross profitability and Grantham quality score generated superior results after controlling got size, value and momentum. Magic formula underperformed the market and Piotroski's F-score did the worst.

Cheong, Ng and Chen (2019) studied two quality investing strategies, gross profitability and F-score, in Asian stock markets during years 2000 and 2016. Markets examined were Korea, Japan, Hong Kong, Singapore and Taiwan. Both F-score and gross profitability earned significant positive results in the cross-sectional regressions. Additionally, financial institutions are buying more high-quality stocks than low quality stocks. The pattern can be found significant in actively managed institutions but not significant in the passively managed institutions.

4.3.2 Combining quality with profitability

Previous studies have found out that some "quality" or "profitability" premiums may exist. For example, Fama and French (2006) noted that firm's profitability is related to positive returns. Chen et al. (2010) examined further that high ROA companies perform better compared to other companies. Novy-Marx (2013) further studied the gross profitability and he found out that this ratio is a powerful tool to explain market anomalies. There has also been international evidence on the profitability strategy related to quality investing. For example, ROE-based strategy has been investigated across global markets. For instance, Garff (2014) used ROE, momentum risk and earnings yield as main factors and all these factors generated positive performance during years 1975-2013. This was even statistically significant at the 99 percent level.

Gallagher et al. (2014) studied how quality stocks performed in the U.S. during 2000-2009 in the portfolios of mutual fund owners. The quality of a stock is inversely related to volatility, while positively related to its market cap. Stocks were organized into quantiles; the lowest quality stocks underperformed statistically to the market portfolio, while the high-quality stocks outperformed the market, which was also statistically significant. The quality was defined here with Q-score, which contained nine variables: ROE, change in ROE, ROA, change in ROA, operating cash flow (OCF), accruals, asset turnover (AO), change in asset turnover, sales growth variability, ROA variability, leverage, liquidity, change in shares outstanding and change in total equity. Gallagher et al. (2014) extended the study into the Australian market. Positive alphas were found in small stocks, micro stocks and large stocks. Also, there was some weak evidence of quality premium in mutual fund returns.

Instead of studying quality investing at stock selection level, Zaremba (2016) studied quality as a concept at country-level. The findings implicated that the more indebted and the more profitable the stock market, the better the performance. By adding country-level value, size and momentum strategies to the formula, the performance can be improved.

4.3.3 Combining quality with responsible investing

The concept of quality investing has often been connected to responsible investing. Becchetti and Ciciretti (2009) studied socially responsible (SR) stocks. They did not find statistically significant risk-adjusted returns in long-only strategies during years 1990-2003 in the U.S. However, looking stocks at an individual level, socially responsible stocks seemed less volatile.

Edmans (2011) studied the long-run relationship between stock returns and employee satisfaction in the U.S. between years 1984 and 2009. The study examined the stock market performance of the 100 best U.S. companies to work in and the results were clear; these stocks significantly outperformed the market.

Hanson and Dhanuka (2015) combined quality investing with responsible investing. They examined sustainability practices, corporate culture and Environmental-Social Governance (ESG) practices and concluded that these factors may yield extraordinary performance. The percentage of independent directors and Bloomberg governance disclosure scores are statistically significant in explaining ROIC.

4.4 Summary of quality investing

In table 2, a summary of quality investing is presented.

Table 2: Summary of quality investing

Definition of quality investing	Novy-Marx's seven quality measures	Combining quality with profitability	Combining quality with responsible investing
There is no clear concept of quality investing; some relate it to financial indicators, other relate it to non-financial indicators, such as sustainable practices. In this thesis, the definition of quality investing has been related to three major groups: Novy-Marx seven quality metrics, profitability and responsible investing.	Graham G-score, gross profitability, Grantham quality score, Greenblatt's ROIC, Piotroski's F-score, defensive equity strategies and Sloan's accruals method	ROA, ROE, Q-score, low debt and high profitability	Socially responsible investing, employee satisfaction and ESG practices

5 COMBINING VALUE INVESTING WITH QUALITY INVESTING

In this chapter, value investing is combined with quality investing. This chapter will examine more closely, what strategies are used to combine value with quality and how these strategies have performed. Finally, a summary of this section is made.

5.1 Performance strategies combining quality with value

Combining quality with value, have not been a widely researched topic. The previous academic literature has concentrated on combining B/P value ratio with some quality ratio. Piotroski (2000) and Piotroski and So (2012) have combined quality with value by forming equally weighted portfolios of value (high book to price) stocks and combined them with Piotroski's F-score. Piotroski (2000) found that by combining high B/P stocks with F-score, excess returns can be generated. The highest benefits can be found with companies that are small and medium-sized, they have low share turnover, no analyst is following the company and the performance is not dependent on firms purchasing low share priced companies.

In addition, Magic formula proposed by Greenblatt (2006, 2010) can be considered as a combined quality and value investing strategy, as the ROIC part can be considered as a quality part, while the EBIT to EV part can be considered as value investing multiple. Greenblatt explained that investors can outperform the market averages by systematically and simply using a formula that seeks out good businesses when they are at bargain prices. The formula has been extensively tested and it has yielded some promising results time after time.

Novy-Marx (2013) found out that combining long and short strategy with equally weighted portfolio of high B/P ratio and gross profitability stocks may produce better results for top 500 largest non-financial U.S. companies, compared to stand-alone strategies. In addition, Novy-Marx (2014) constructed long-only 50:50-portfolios with high B/P ratios and the other seven quality strategies. He found out that by combining value with ROIC, Piotroski's F-score and gross profitability yielded higher results than as a stand-alone strategy for large cap stocks.

Lalwani et al. (2017) combined value with quality by forming equally weighted portfolios of value (high book to market ratio) stocks and quality (Grantham's quality score, magic formula, F-score and gross profitability) stocks in the Indian stock market. Overall, the results showed no significant improvement on shifting from quality investing strategies into a combination of quality and value investing strategies.

5.2 Summary of combining value investing with quality investing

Table 3 summarizes the definition of what is meant by combining quality with value and what existing combined quality and value ratios there exist.

Table 3: Definition of combining quality with value and existing combined quality and value ratios

Definition of combining quality with value	Existing combined quality and value ratios
Value investors try to buy stocks that are cheap but tend to be of low quality	EBIT to EV and ROIC
Quality investors try to buy stocks that have uncommonly productive assets while the stocks tend to be expensive	Combining B/P ratio with Novy-Marx seven quality metrics
Combining quality with value is made by constructing equally weighted portfolios of both combinations of quality and value. Should be both cheap and of high quality.	

6 PREVIOUS RESEARCH

In this section, previous research is examined more closely. The motivations to introduce these studies more precisely are given. The data section, methodology part and results are examined closely. Finally, a summary is made of previous research.

6.1 Leivo & Pätäri (2009)

The purpose of this study was to investigate the performance of the value strategies in the Finnish stock market. This study was the first one to study the performance of the different value investing in the Finnish stock market. By introducing this study, the author aimed for a more complete picture regarding the performance of various value investing strategies compared to growth stocks. Because this study examined the Finnish market, this study may give indications on more recent performance of these strategies, thus contributing to the research hypothesis of this thesis. The best performing value ratios are also investigated.

6.1.1 Data and methodology

Pätäri & Leivo (2009) studied the performance of the value strategies in the Finnish stock markets between years 1993-2008. The main list of the Helsinki Stock Exchange was examined. Data was taken from DataStream and to avoid survivorship, all stocks are included, even the ones that were delisted during the period. If companies had two or more types of shares, only the stock series that had the highest liquidity was included. Adjustments for splits, capitalization and dividends were also made. The number of companies included was set to vary between 51 and 110, depending on the exact time.

Ranking was based on valuation multiples and the portfolios were rebalanced annually on the May 1st. The portfolios were divided into three quantiles, while monthly prices were used. Portfolios were created by dividing the book to market price ratio, cash-flow to price ratio, earnings to price ratio, EBITDA to EV ratio, dividend to price ratio and sales to price ratio into six portfolios. In addition, portfolios were created based on two combinations of D/P and EBITDA/EV, S/P and EBITDA/EV and B/P and EBITDA/EV. Moreover, portfolios based on three multiples were created with ratios B/P, D/P and E/P, B/P, D/P and EBITDA/EV and S/P, B/P and EBITDA/EV. Lastly, portfolios consisting of four ratios were created with multiples CF/P, B/P, D/P and EBITDA/EV and S/P, B/P, D/P and EBITDA/EV.

Risk-adjusted performance was tested with Sharpe ratio, adjusted Sharpe ratio which examines the skewness and kurtosis of the stock returns, Jensen's alpha and a two-factor alpha. Ledoit-Wolf tested the statistical difference of comparable pairs of the Sharpe ratio. Newey-West standard errors were used as well to look for autocorrelation and heteroskedasticity. Normality test of Jarque Bera was tested as well as the multicollinearity, which was measured when there were more than two explanatory variables with a variance inflation variable (VIF). Neither non-normality nor multicollinearity was found.

6.1.2 Results

Measuring portfolios individually with only one value ratio, D/P yielded the best performing portfolio with an annual alpha of 10,03%. This result was statistically significant at the 1% level. In addition, it had the highest risk-adjusted performance measured with Sharpe ratio and adjusted Sharpe ratio. The second highest alpha was given by EBITDA/EV which was 7,45% per annum. The results were statistically significant at the level of 5%. Next up was E/P and CF/P, which had alphas of 6,66% and 5,86%, respectively. The other individual ratios were not statistically significant, even though the results showed slightly positive ratios.

Combining value ratios with one another yielded even more superior performance. The best performing strategy with three quintile portfolios was with B/P, D/P and EBITDA/EV and it had an annual excess return of 10,85%. The second-best strategy was with D/P and EBITDA/EV and it had alpha of 10,74%. Both strategies were significant at the level of 1%. As a conclusion, all value investing strategies seemed to outperform the market, although not all of them were statistically significant. Worst performing strategies were B/P and S/P.

The presence of value premium was also tested. The performance between the value portfolios and glamour portfolios were examined. These results indicated that value premium exists, and the most significant value premium is generated with dividend yield and combinations from it. For example, the 2-factor alpha spread is showing a combined ratio for B/P, D/P and EBITDA/EV at an annual excess return of 14,96%. The results were divided into subperiods, too.

6.2 Davydov, Tikkanen & Äijö (2016)

The study by Davydov, Tikkanen & Äijö examined the performance of the magic formula and cash-flow augmented magic formula and compared it to the most widely used value investment strategies in the Finnish Stock Market between years 1991-2013.

This paper was chosen to this thesis because this is the first study testing the performance of the magic formula in a smaller market, namely in the Finnish stock market. The magic formula may be considered as a combination of quality and value. The author of this thesis is also interested in its performance and how the other value investing strategies have performed in the Finnish market. It is interesting to find out, how the data was collected and what methodologies were used.

6.2.1 Data and methodology

The magic formula consisted of EV/EBIT ratio and ROIC ratio, while the cash-flow augmented magic formula consisted of EV/EBIT, ROIC and CF/P ratios. The top 30% stocks were weighted equally into the magic formula portfolios. The companies were ranked by the highest ROIC and lowest EV/EBIT ratios and the last step was to average the companies. The cash-flow augmented magic formula was formed by the same way, but the portfolio also included ranking the CF/P ratios. The value investing portfolios included the top 30% equally weighted stocks formed of ratios B/P, CF/P, E/P and EBIT/EV.

As risk-adjusted performance measures, this study used the Sharpe ratio and Sortino ratio. Carhart's four factor model was used to capture the portfolio's ability to yield abnormal returns which consisted of market-, size- value- and momentum factors.

6.2.2 Results

The results showed that magic formula produced during years of 1991-2013 an average annual return of 19.3%, while the cash-flow augmented magic formula yielded a return of 20.2%. Even higher return was found with EBIT/EV that had a mean annual return of 20.6%, while the E/P strategy had a mean annual return of 20.5%. B/P had the lowest annual return with 16.74% followed by CF/P with a mean annual return of 19.04%. All of these strategies performed better than the market (13.63%).

While taking into account the risk-adjusted performance, according to the highest Sharpe ratio, the EBIT/EV strategy performed the best followed by the cash-flow augmented magic formula, E/P and magic formula. While looking at the Sortino ratio, the EBIT/EV and E/P strategies performed the best, the worst performing ratios were B/P and CF/P. If comparing to the market portfolio, in all cases both the magic formula strategies and the traditional value investing strategies outperformed the market.

Carhart's four factor model showed that the best performing strategies were cash-flow augmented magic formula (7,7%), EBIT/EV (7,6%), E/P (7,22%) and magic formula (6,71%). All these alphas were statistically significant at the level of 5%. CF/P and B/P generate positive alphas also but could not be considered statistically significant. The long-short portfolios generated by value portfolios and growth portfolios showed that all alpha spreads were positively statistically significant, except the B/P ratio, which was not statistically significant, although positive. Statistically significant loadings could be found with size factor on EBIT/EV, CF/P and B/P. Negative loadings on momentum were found by CF/P and E/P ratio. The performance of the value strategies was also examined during bull and bear markets.

6.3 Novy-Marx (2014)

The purpose of the study was to examine how different quality strategies, namely Graham's G-score, Grantham's quality score, Greenblatt's ROIC, defensive investor strategy, earnings quality, gross profitability and Sloan's accruals, performed in the U.S. This paper was chosen, because it is the first study to divide quality investing into seven fundamental quality metrics.

6.3.1 Data

Quality portfolios were constructed by ranking firms based on the seven-quality metrics. The sample period was between 1963 and 2013. Companies included could be both financial and non-financial companies. Equal portfolios were constructed by buying (shorting) the top (bottom) 30 % quality stocks. Additionally, long-only strategies were created. Portfolios were rebalanced every year at the end of June. Accounting data was used from the last years' financial statement. Transaction costs were calculated into expected returns.

6.3.2 Methodology and results

Excess returns were first examined. Gross profitability performed the best with a spread of 2,70% per annum. After gross profitability, the best performing strategies were F-score (2,24%) and ROIC (2,17%), respectively. The worst performing strategies were defensive investor (-1,55%), Grantham's quality score (-0,55%) and Graham's G-score.

Secondly, three-factor model was used to test the performance of these seven strategies and the value (book-to-price) strategy. Long/short portfolios were created. When looking at three-factor model, the results were better. Gross profitability, F-score, ROIC and Grantham's quality score produced statistically significant alphas, 5,21%, 4,33%, 4,66% and 4,84%, respectively. All strategies had negative loadings on the market factor and tilted towards large cap stocks. Graham's G-score, Grantham's quality score, F-score and gross profitability tilted towards growth stocks.

Seven quality strategies were compared with each other, with a series of spanning tests. Spanning tests were done, in order to test if these strategies generate significant alphas compared with each other. The results showed that all these strategies generate positive abnormal returns, although the results were modest and statistically insignificant. Only gross profitability and Grantham's quality score generated significant positive alphas.

While the above strategies used both long and short strategies, Marx also examined long-only investors. All quality strategies produced positive alphas, although gross profitability was the only strategy, which generated statistically significant results at the level of 5%. The alpha value ranged from 0,03 per cent per annum to 1,44% per cent per annum.

Long-only quality was combined with value ratio book-to-price. Combining quality with value produced positive returns that had a better risk-reward relationship than stand-alone strategies of quality had, except earnings quality strategy and defensive investor strategy, which did not yield better performance, when quality was combined with value. The risk-adjusted performance was measured with Sharpe ratio, information ratio and tracking error. The performance of long-only strategy that combined book-to-price with quality metrics were also examined with a three-factor model. Combining valuations with ROIC, F-score and gross profitability yielded superior results in the large cap universe. All in all, this study suggested that investors should pay attention to both price and quality.

6.4 Lalwani & Chakraborty (2018)

The purpose of the study was to investigate fundamental quality investing in the Indian stock market. This study used Grantham's quality score, magic formula, Piotroski's F-score and gross profitability as quality metrics. This study was chosen as it examined quality investing, while special interest in what quality metrics were used and why.

6.4.1 Data and methodology

The data consisted of the BSE-500 index between years 2001-2016 and only non-financial companies were taken into the sample. Database used was Prowess database of CMIE. Portfolios were constructed on October 1st and long-only portfolios were constructed for Grantham quality score, gross profitability and Magic Formula and the top 30% per ranking was defined. Piotroski's F-score was created with those firms that scored above seven or more. Graham's G-score and earnings quality were excluded from this study as there is not enough available data. Also, the defensive portfolios were excluded from the sample. Portfolios were rebalanced every year and the portfolios were equally weighted. Daily stock returns were taken.

Risk-adjusted performance was studied with Sharpe ratio. The performance was compared to a passive counterpart and the portfolio returns were regressed against the Carhart's four factor model. The CAPM was also tested. In order to exclude bias from the results, Newey-West heteroskedasticity and autocorrelation corrected (HAC) standard errors were used.

6.4.2 Results

This study came to conclusion that Grantham quality score outperformed on average the market portfolio annually with 4,43 per cent, while the Magic formula underperformed the index by 0,82 per cent annually. Both gross profitability and Piotroski's F-score outperformed the markets by 4,38% and 2,20% respectively.

Risk-adjusted returns were considered with Sharpe ratio and these findings indicated that on average Grantham quality generated an excess return of 14,72%, while magic formula, gross profitability and F-score generated excess returns of 8,50%, 8,59% and 14,98% respectively.

CAPM and Carhart's four factor model indicated that both gross profitability and Grantham quality score yielded positive statistically significant results. CAPM was for gross profitability 0,51% while for Grantham quality score it was 0,38%. Four factor model yielded respectively 0,42% and 0,28%. While also F-score produced positive excess returns, these results were not statistically significant. Magic formula produced a negative alpha, although the results were insignificant.

The results were also divided into three sub-periods: 2001-2005, 2005-2010 and 2011-2015. These tests were done to test the robustness of these results. The results indicated that Grantham's quality score performed well during good times and it had a significant loading on the momentum, while the gross profitability strategy performed well during both bull and bear markets.

Lastly, the quality was combined with value by creating equally weighted portfolios with value (high book to market ratios) and quality strategies that have been used in this study. By adding a value portfolio, the overall performance of the quality portfolios decreased. Grantham's quality portfolio reduced from 4,43% to 3,34%, while the gross profitability score decreased from 4,38% to 2,21%. On the other hand, magic formula increased to 0.97%, To compare the performance of quality-value portfolios with quality only, spanning tests were conducted. These tests implied that there was no significant gain from shifting from quality strategy into a quality-value strategy.

6.5 Summary of most relevant previous research

A summary of the most relevant previous research is presented in table 4.

Table 4: Summary of most relevant previous research

Authors	Purpose	Period	Market	Method	Key findings	Relevance
Leivo & Pätäri (2009)	Measuring the performance of different value investing strategies in the Finnish Stock Market	1993-2008	Finland	Sharpe ratio, adjusted Sharpe ratio, Jensen's alpha, two-factor model	There is evidence of value premium to exist in the Finnish stock market. Best performing individual value strategies are D/P, EBITDA/EV and E/P. Combining value ratios with each other yields even better results. Best performing combinations are B/P, D/P and EBITDA/EV and D/P and EBITDA/EV.	The first study in the Finnish stock market to compare the different value investment strategies. Giving indication how the different value ratios are performing.

Davydov, Tikkanen & Äijö (2016)	To measure the performance of the magic formula in the Finnish stock market and compare it to other traditional value investment strategies	1991-2013	Finland	Sharpe ratio, Sortino ratio & Carhart's four factor model	All value investing strategies and magic formula performed better than the overall Finnish market. Best performing multiples were EBIT/EV, E/P, cash-flow augmented magic formula while the worst performing strategy were with B/P and CF/P. Results were statistically significant.	First study to test the performance of magic formula in a smaller market. Of our interest is to how the strategies have performed and what methodologies used.
Novy-Marx (2014)	To measure the performance of quality portfolios based on seven quality metrics and investigate what happens if quality is combined with value.	1963-2013	USA	Sharpe ratio, CAPM, IR, tracking error,3factor model, spanning tests	All quality strategies have some power predicting returns although gross profitability generates only significant excess returns as a standalone strategy. By combining quality with value, yields better risk-return relationship. Benefits both long-only investors and long/short investors.	First study to divide quality investing based on seven fundamental quality metrics. Combines quality with value for the first time in the U.S.
Lalwani & Chakraborty (2018)	Study the performance of fundamental investing strategies in the Indian stock market	2001-2016	India	Sharpe ratio, Carhart's four factor model, CAPM	Grantham quality score, gross profitability and F-score have outperformed the markets while magic formula has underperformed the market. Best performing strategies were Grantham quality score and gross profitability. Overall, by combining value with quality, the performance decreases.	This study divides stocks based on fundamental quality metrics which is of interest. In addition, this study looks into what happens if quality is combined with value.

7 DATA

In this chapter, the data collection process for the empirical study is covered in detail. Firstly, the data sample selection process is revealed. Secondly, the financial variables that are used in this thesis are presented. Thirdly, the process of portfolio formation is described in detail. Fourthly, the justification, how the portfolio returns are calculated, which proxies are used for risk-free rates and which market portfolios are used to capture the relative performance of the portfolios, are presented. Fifthly, data related to the factor models are discussed. After that, the transaction costs talked over. Finally, the descriptive statistics, yearly returns and correlations among quality – and value portfolios are reviewed.

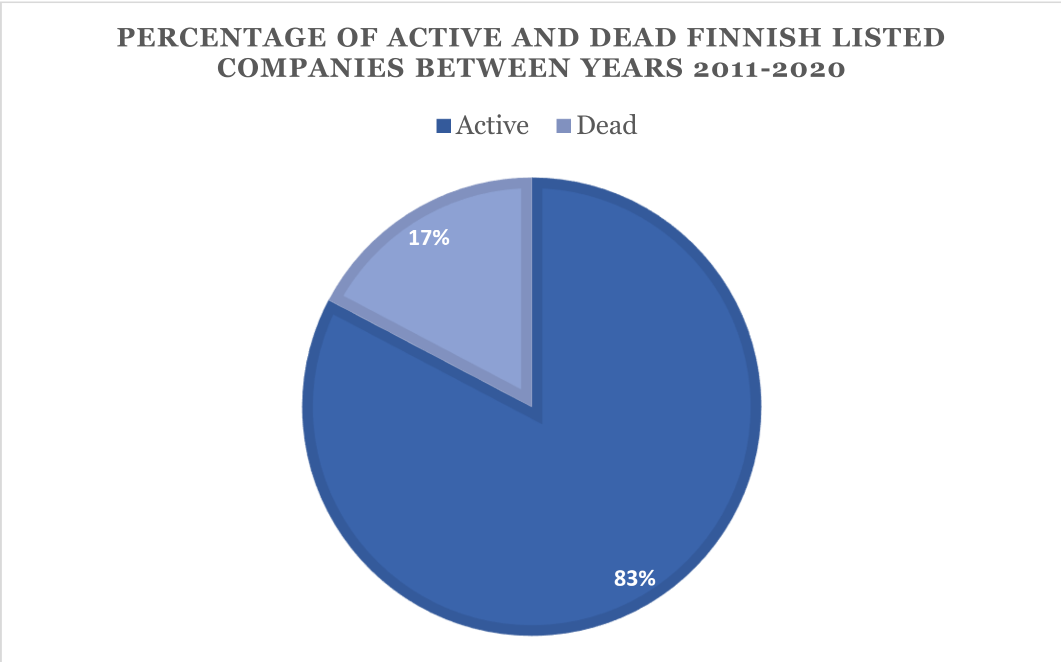
7.1 Data sample selection process

The portfolios consist of Finnish stocks quoted on the main list of Helsinki Stock Exchange (Nasdaq Helsinki) during 1.6.2011-1.2.2020. The sample consists of both active and inactive companies. The companies included have been retrieved from Thomson Reuters Datastream. In this screen, all public companies that include active, inactive, public and primary companies from the Finnish stock market, are part of the sample. Only companies listed in the main list in the Helsinki Stock Exchange are included in the sample. Companies listed on the First North exchange are excluded to avoid the potential illiquidity problems. This yields 166 active Finnish listed companies for the time period.

In addition, firms that have delisted during the sample period must be included, in order to avoid survivorship bias. If survivorship bias is not taken into account, the sample may give too optimistic results, as the sample consists of only observations that survived the process and the losers are unobservable. Delisting can be related to, for instance, companies that have gone bankrupt or companies that have been acquired. The data have been downloaded from Thomson Reuters DataStream database. Dead companies that were found in total was for 164 for Finnish listed companies. After that, dead companies were sorted so that the companies had to exist in sometime between 2011 and 2020. If the companies had been dead before 2011, they were excluded from the sample.

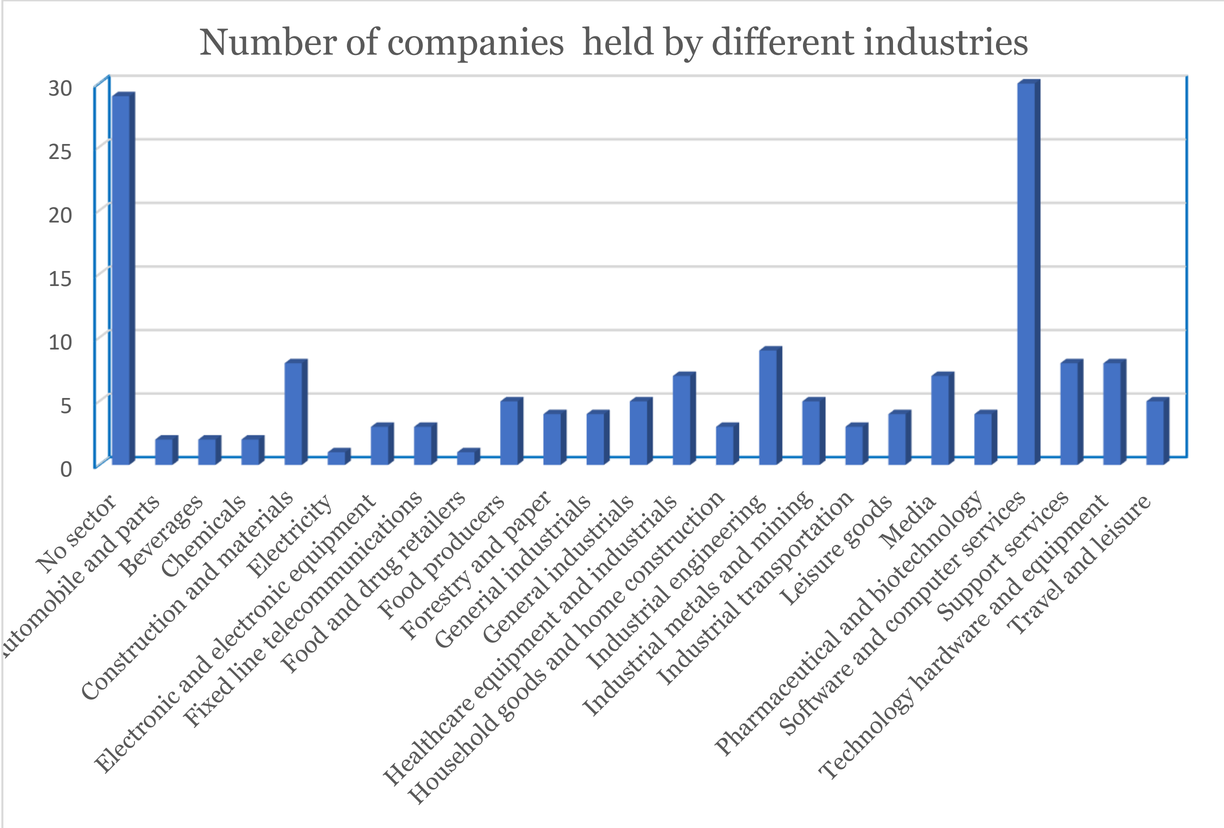
In the next step, the financial companies are excluded. Following Fama and French (1992) and Asness et al. (2018), financial companies are excluded, because they have different views of how the financial statements are interpreted. In Thomson Reuters DataStream database, these are categorized as financial services, banks, non-equity investment instruments, real estate investments and services and nonlife insurance companies. This yielded 134 active - and 28 dead Finnish listed companies for the whole sample period. The distribution of Finnish listed active and dead companies can be seen in figure 1. Active companies account for 83 per cent of the companies included in the sample and dead companies account for 17% per cent of the companies included in the sample.

Figure 1: Percentage of active and dead Finnish listed companies between years 2011-2020



The number of companies held by different industries are illustrated in figure 2. It can be noted that the distribution is mainly consisting of companies that are not categorized in the Thomson Reuters database and of companies that are grouped as software and computer services. Overall, the distribution is quite technology oriented. This might impact the portfolio construction as the portfolios can be exposed to certain industries, such as the software and computer services industry.

Figure 2: Number of companies held by different industries



7.2 Financial variables

Value variables that have been chosen to this thesis are E/P, EBIT/EV, D/P and B/P. E/P, EBIT/EV and D/P are chosen based on previous research; these have been the best performing multiples in the past in the Finnish stock market. B/P is chosen as maybe the most famous value investing variable in the finance literature. In addition, B/P variable has also been associated with quality metrics by creating equally weighted portfolios.

Quality ratios that have been chosen to this thesis are Grantham´s quality score, gross profitability and ROIC. The variables are inspired by Novy-Marx (2014). Grantham's quality score and gross profitability score have been the most prominent quality variables. ROIC is chosen as well because it has been related with EV/EBIT value variable.

Novy-Marx (2014) used the following quality variables; Defensive equity strategy, Graham's G-score, Piotroski's F-score and Sloan's accruals. On the contrary, this thesis wanted to concentrate on simple quality variables and that's why no binary variables are used. That is why G-score and F-score were excluded. In addition, Novy-Marx (2014) concluded in his paper that earnings quality strategy should not be classified as a quality strategy. That is why this variable was excluded from the sample. This study is also limited to financial indicators that are based on company fundamentals and that's why defensive equity strategy is excluded from the study. Next, the formulas for variables that have been included in this thesis, are introduced. Both value variables and quality variables are calculated annually.

7.2.1 Value variables

The book to price formula is the following:

$$\frac{B}{P} = \frac{Book\ price}{Market\ price} \tag{1}$$

Book price represents proportioned common equity, divided by outstanding shares at the company's fiscal year end. Market price is the closing price of the company's stock at the last day of their fiscal year end (Thomson Financial, 2007).

Dividend to price has the following equation:

$$D/P = \frac{Dividends\ per\ share}{Market\ price} \tag{2}$$

Dividend per share is the total dividend per share declared during a company's fiscal year. Extra dividends are included, but special dividends are excluded (Thomson Financial, 2007). Market price is calculated the same way as in the above equation.

Earnings to price are calculated with the below formula:

$$\frac{E}{P} = \frac{Earnings\ per\ share}{Market\ price} \tag{3}$$

Earnings per share represent earnings for the 12 months ending the fiscal year of the company (Thomson Financial, 2007). Market price is again calculated in a similar fashion.

Earnings before interest and taxes to enterprise value is calculated as per below:

$$\frac{EBIT}{EV} = \frac{Earnings\ before\ Interest\ and\ Taxes}{Enterprise\ value} \tag{4}$$

Earnings before interest and taxes consist of the earnings of a company before interest expense and income taxes. Calculations are made by taking the pre-tax income and adding back interest expense on debt. After that, the interest capitalized is subtracted. Enterprise value is calculated by taking the market capitalization at fiscal year-end date, adding the preferred stock, minority interest and total debt, minus cash. Cash consists of cash for insurance companies, cash & due from banks for banks and cash & short-term investments for all other industries (Thomson Financial, 2007).

7.2.2 Quality variables

Grantham's quality score is calculated with the following formula:

$$Grantham's\ quality\ score\ = \frac{ROE\ + ROE\ volatility + \frac{Total\ assets}{Book\ equity}}{3} \quad (5)$$

Grantham's quality score consists of return on equity, inverse ROE and total assets to book to equity. ROE is calculated by the following formula: Net Income before Preferred Dividends - Preferred Dividend Requirement) / Average of Last Year's and Current Year's Common Equity * 100. Inverse ROE is calculated by taking the arithmetic average of the last five years of the ROE and then calculating the standard deviation from it. Total assets represent the sum of total current assets, investments in unconsolidated subsidiaries, long term receivables, net property plant and equipment and other assets. Book equity represents the common equity by the fiscal year end (Thomson Financial, 2007).

Gross profitability is calculated as per below:

$$Gross\ profitability = \frac{Gross\ income}{Total\ assets} \quad (6)$$

Gross profitability is calculated by dividing gross income with total assets. The composition of gross income is the difference of sales/revenues and cost of goods sold (COGS), depreciation and amortization (Thomson Financial, 2007). Total assets are calculated same way as above.

The return of invested capital is as following:

$$ROIC\ =\ Return\ on\ Invested\ Capital \quad (7)$$

The Return on Invested capital is calculated with the following formula: (Net Income before Preferred Dividends + ((Interest Expense on Debt - Interest Capitalized) * (1-Tax Rate))) / Average of Last Year's and Current Year's (Total Capital + Last Year's Short Term Debt & Current Portion of Long Term Debt) * 100 (Thomson Financial, 2007).

In table 5 the database codes are presented.

Table 5: Database codes

The table shows database codes. The "WC" stands for the prefix, which is an abbreviation of the codes that belong to the Worldscope database.

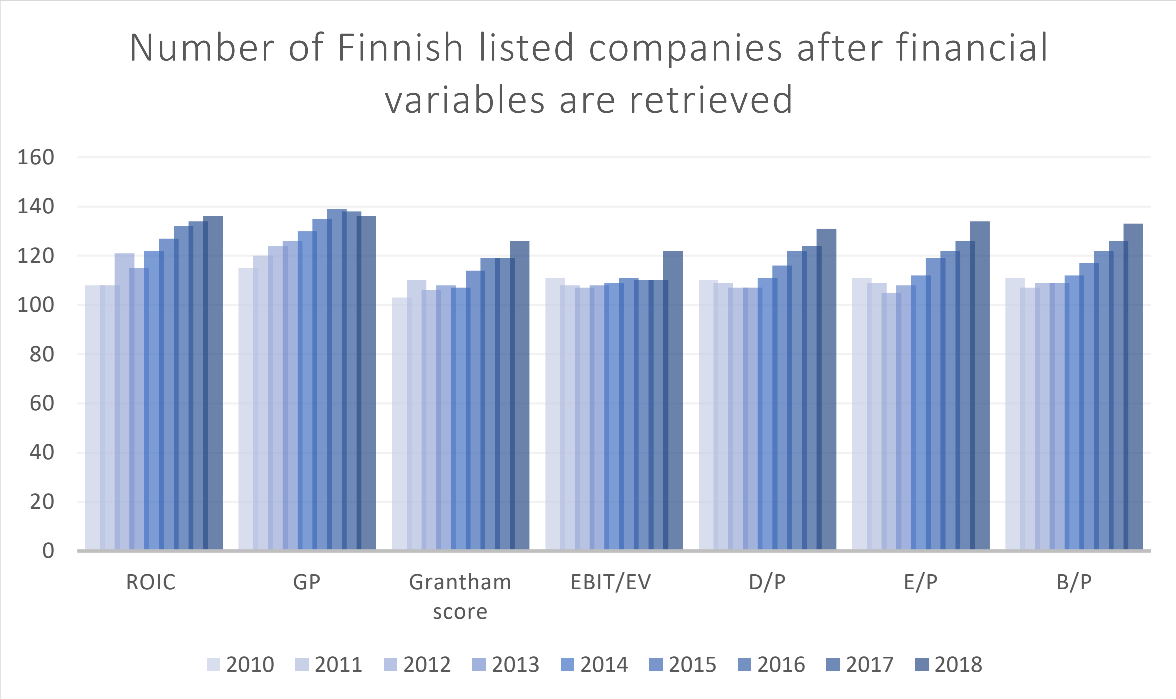
Database codes
Gross Income (WC01100)
Total assets WC02999)
ROIC (WC08376)
EBIT (WC18191)
EV (WC18100)
ROE (WC08301)
Average of ROE 5 years (WC08305)
Market price - year end (WC05001)
Book equity (WC07220)
Earnings per share - fiscal Period End - WC05202
Dividend per share (05110)

7.3 Portfolio formation

Portfolio formation is based on financial variables that have been taken at the end of the previous year and the portfolios are formed every year on the first day of June. The portfolios are rebalanced every year. By using this approach, there is a reduced risk of look-ahead bias occurring in the sample. Look-ahead bias refers to a situation, in which the researcher uses data that were not available at the time being analyzed. In this kind of studies, it is quite common to use a 1-year holding period frequency and to base the portfolio rebalancing date between May and July. For example, Pätäri (2009) used a one-year holding period and, for example, Fama and French (1992) and Chen et al. rebalanced their portfolios on the last trading day of June.

After the companies which are included in the sample are revealed, companies' financial variables are retrieved from Thomson Reuters Worldscope database. All companies that do not have enough financial data to construct the variables, are excluded. In total, the number of Finnish listed companies varies from 108 to 136 between different years and financial variables. In the figure 3, a pattern that the number of companies is increasing from 2010 to 2018, can be noticed.

Figure 2: Number of Finnish listed companies after financial variables are retrieved



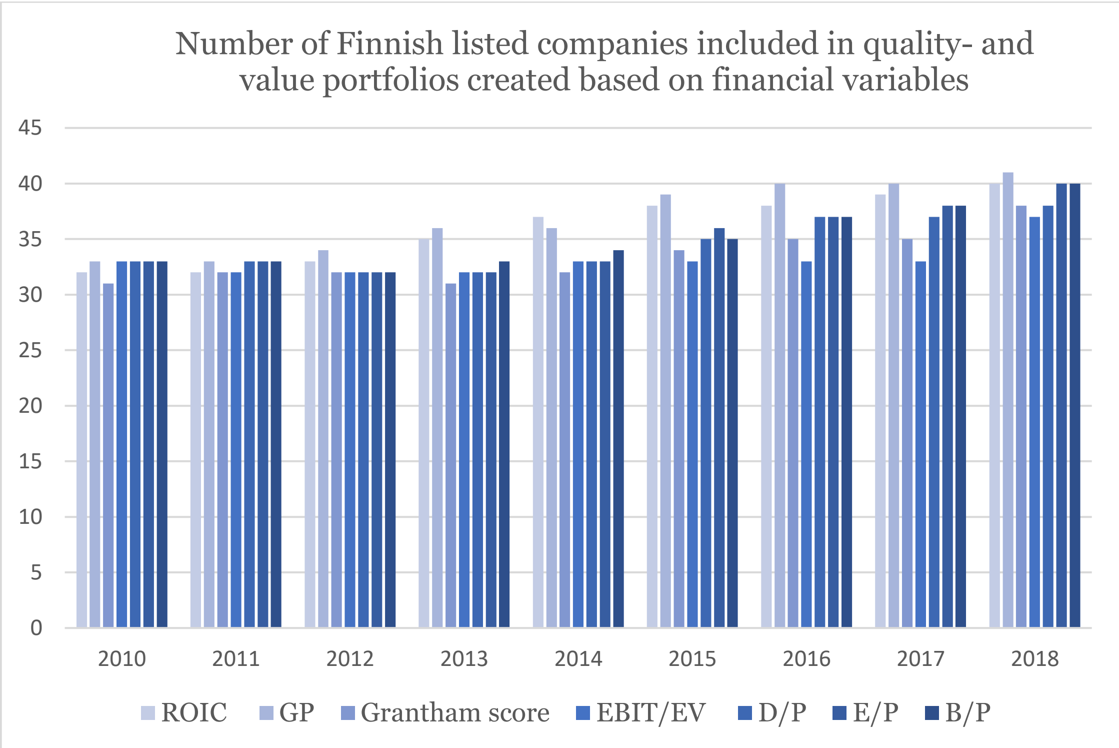
7.3.1 Forming the value -, quality- and combined value and quality portfolios

Long only value portfolios include the top 30 per cent of equally weighted stocks ranked based on ratios B/P, D/P, E/P and EBIT/EV. The higher the ratios, the higher the ranking. In the same vein, quality ratios ROIC and gross profitability are created. The higher the ratios, the higher the ranking. Grantham's quality score is averaged based on three criteria: ROE, inverse ROE and total assets to book equity. The higher the ROE, the higher the ranking, while the lower the inverse ROE and total assets to book equity, the higher the ranking.

After the top 30 per cent portfolios are formed, the monthly historical prices are retrieved for the companies that are included in the portfolios from Thomson Reuters Datastream database. If historical prices are not found for the companies that are included in the portfolios from Datastream, these companies are excluded from the sample. If a company is excluded from the sample based on that the company do not have historical price information, the portfolio is rebalanced so that the portfolio includes the top 30 per cent every year. Lastly, it should be noted that rankings are accounted for negative ratios of the coefficients. Companies that have negative ratios, are ranked after companies that have positive ratios.

In figure 3, the number of Finnish listed companies included in portfolios that are created based on financial variables are revealed.

Figure 3: Number of Finnish listed companies included in quality- and value portfolios created based on financial variables



Portfolios of both value and quality ratios are constructed using long only strategies. Method used in this thesis was applied by Davydov, Tikkanen and Äijö (2016) as well. The process is as follows:

1. In the first step, companies are ranked based on a certain value metric e.g. the companies showing highest B/P, D/P, E/P or EBIT to EV ratio are assigned in the first place.

2. In the second place, companies are ranked based on a certain quality metric e.g. companies showing highest gross profitability, Grantham quality score or ROIC ratio are assigned first place. It should be noted that both value and quality metrics are accounted for negative values.

3. In the final step, the ranking of companies is averaged, i.e. if a company is ranked fourth based on the value metric and third on the quality metric, its average ranking will be 3.5. Subsequently, the companies are sorted by those average rankings.

After ranking the companies, the top 30 per cent portfolios are constructed of combined quality and value portfolios. In total, 12 combined quality and value portfolios exist. In figure 4 and 5, the number of Finnish listed companies included in combined quality and value portfolios created based on financial variables are presented. A similar pattern with the combined quality and value portfolios can be seen with quality portfolios and value portfolios, while the number of companies are roughly increasing. However, one must note that the number of companies with combined quality and value portfolios are little less than with quality portfolios and value portfolios. This can be explained by the fact that both value ratios and quality ratios must be found in order to the company included in the sample.

Figure 4: Number of Finnish listed companies included in combined quality and value portfolios created based on financial variables (1/2)

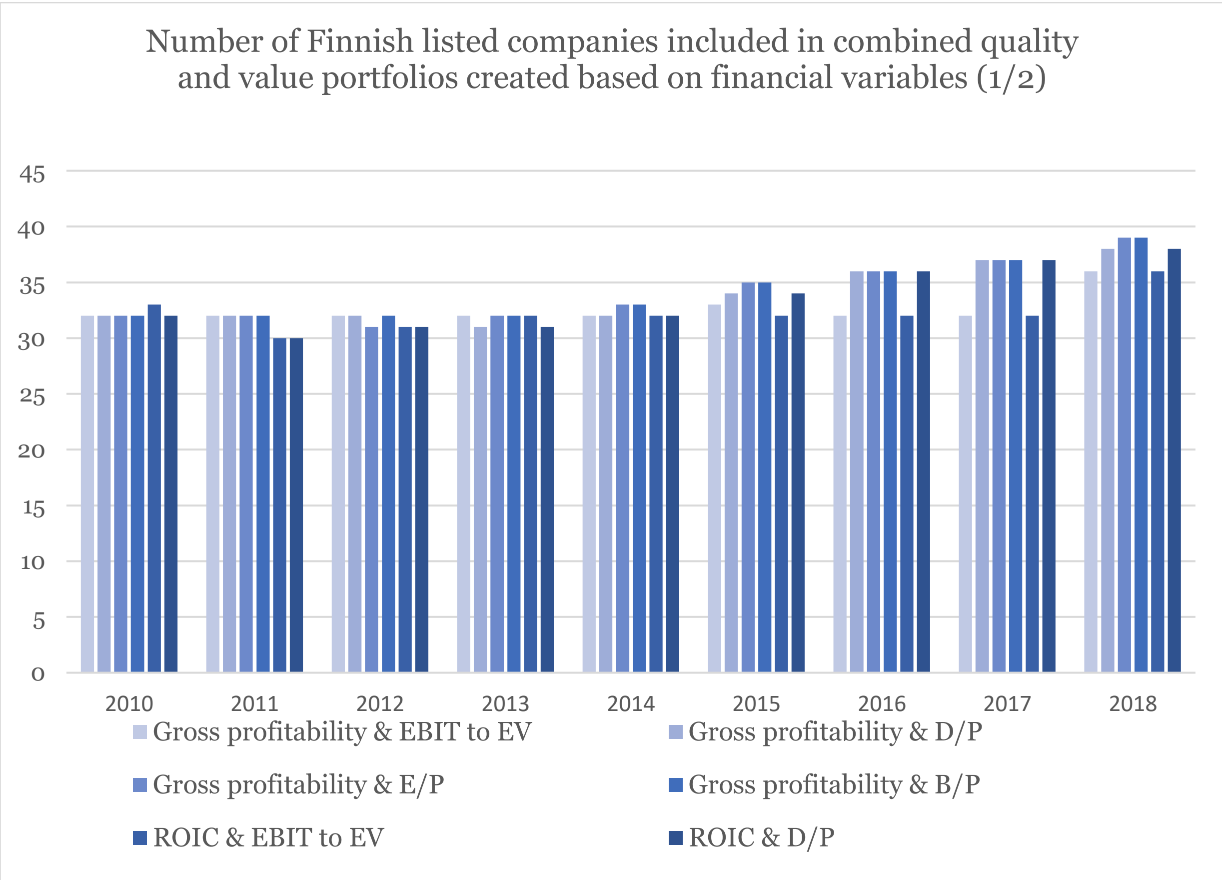
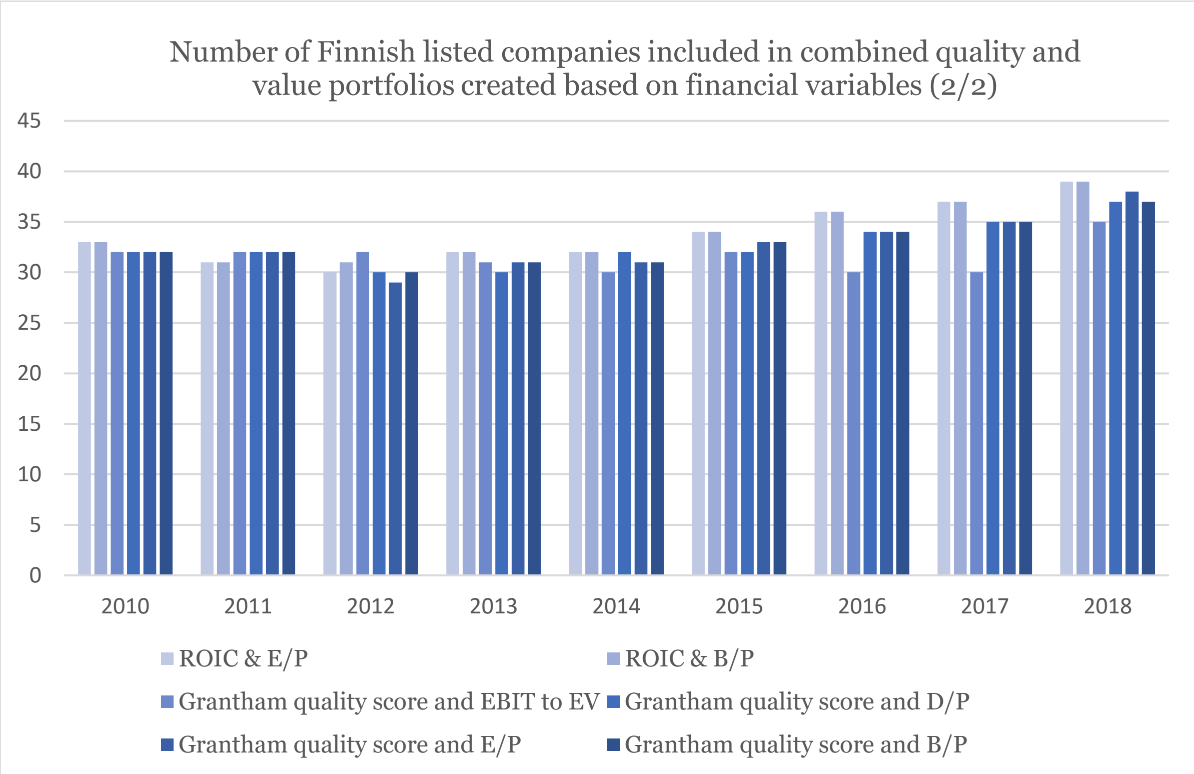


Figure 5: Number of Finnish listed companies included in combined quality and value portfolios created based on financial variables (2/2)



7.4 Data selection

After the portfolios are formed, stock prices for the companies are collected from Thomson Reuters database. Stock prices are taken monthly for the time period 2011-2020. Thereafter, the holding period returns (HPR) are calculated by the following formula:

$$R_t = \frac{P_t - P_{t-1} + DIV_t}{P_{t-1}} \tag{8}$$

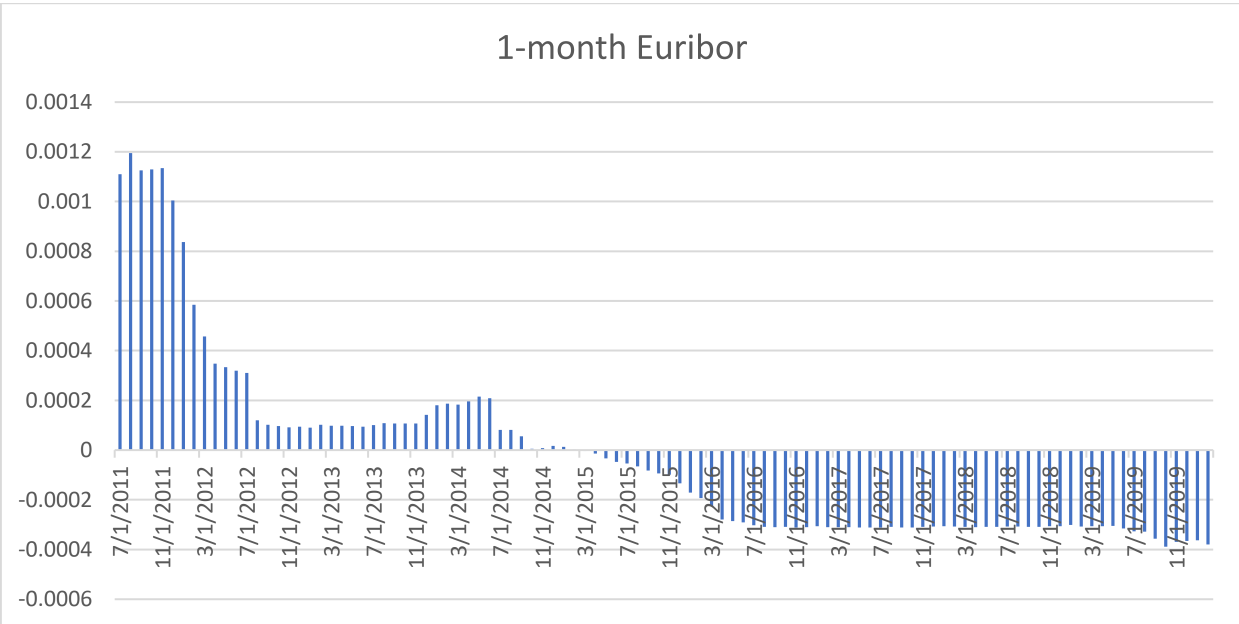
Where the R_t is the arithmetic rate of return at time t, P_t is the price of the stock at time t, P_{t-1} is the price of the stock at t-1 and DIV_t is the dividend at time t. This formula gives the realized return for an individual stock during the holding period. For the calculation of the portfolio return, the following extensions can be made:

$$R_{p.t} = \frac{1}{N}(R_{1.t} + R_{2.t} + \cdots + R_{N.t}) \tag{9}$$

Where $R_{p.t}$ is the portfolio return, N is the number of securities held within the portfolio and $R_{1.t}$ is the arithmetic return for asset i in the portfolio. By dividing the individual securities with the number of securities, the return for equally weighted portfolio is given.

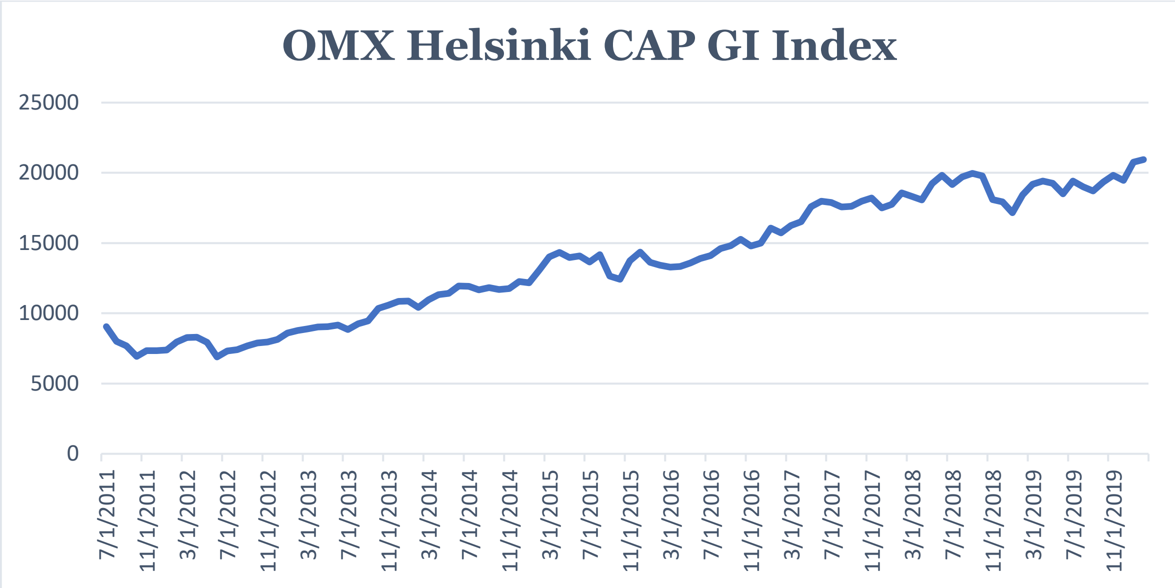
1-month Euribor (Euro Interbank Offered Rate) is used as risk free rate for Finland. The data is retrieved from European Banking Federation. The Euribor rates are average interest rates at which many European banks borrow funds from each other. These Euribor rates can be considered as risk free rates even though in reality there exist no risk-free rates. The Euribor rates are reported daily with annual figures. To get these figures monthly, the Euribor rates are divided by 12. In figure 6, the Euribor rates are illustrated for the time period of 2011-2020. As we can see from the figure, the interest rates have been negative since 2015.

Figure 6: 1- month Euribor



The market portfolio that is used for Finland, is OMX Helsinki CAP GI. This index is a total return index which account for dividends, splits and other capitalization actions. This index is also a capped index, meaning that the maximum weight for a single company is 10%. In figure 7, the OMX Helsinki Cap Gi index is illustrated. As from the figure it can be seen that the time period has been quite bullish.

Figure 7: OMX Helsinki Cap GI Index



Following Davydov et al. (2016), if a stock is delisted during the holding period, the stock is sold on its last trading date and invested at the risk-free rate, until the portfolio is rebalanced. Cash dividends are reinvested in the same stock. In addition, if a company goes bankrupt during the holding period, -100% is the return of that stock. If companies have two or more shares, only the stocks series that has the highest liquidity, is included. Additionally, adjustments for capitalization, dividends and splits, are made.

7.5 Factor data

In the methodology part, factor models are used. The factor data for the factor models is obtained from the Kenneth French online library. This study uses the readily available European factors. Reason for using these factors are that it removes the need for creating new factors and as we are living in a highly global world where companies are more and more international, the relevance of the European factors is very high.

7.6 Transaction costs

Transaction costs are not taken into account in this thesis. This thesis has a more theoretical approach and that is why these transaction costs are not included in this thesis. This could have an effect on the robustness of the results. For example, Davydov and Tikkanen (2016) estimated that the transaction costs varied between 0.50% and 0.58% during years 1991 and 2013. Additionally, Jegadeesh and Titman (1993) suggested that one-way transaction costs very between 0.23% and 0.50%.

7.7 Descriptive statistics

The descriptive statistics for this thesis are presented in this section. First, the descriptive statistics for quality- and value portfolios are displayed. Second, the descriptive statistics for combined quality and value portfolios are presented and compared with the findings unveiled for the quality- and value portfolios.

The descriptive statistics cover the results for arithmetic mean which measures the central tendency, median which is the observation that cuts the sample in two equally large subsamples and the minimum - and maximum values which are measures of location are presented. In addition, standard deviation which is a measure of dispersion, skewness that accounts for measuring asymmetry and kurtosis which measure the fat-tailedness and peakedness of the sample are presented. For normally, distributed variables, the skewness is zero and kurtosis is three and hence the excess kurtosis is zero. Jarque-Bera test is also used for testing normality.

7.7.1 Descriptive statistics for quality and value portfolios

Table 6 presents descriptive statistics for the quality – and value portfolios that have a period from 2011 to 2020.

Table 6: Descriptive statistics for quality- and value portfolios

The table shows the descriptive statistics for quality- and value portfolios. The mean, median, maximum value, minimum value and standard deviation are calculated based on the monthly returns, but the reported figures are annualized. Reported skewness and kurtosis are calculated based on the monthly returns. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Name	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P	OMX Helsinki
Mean	11.4%	9.8%	13.6%	11.1%	11.6%	11.4%	8.9%	10.3%
Median	7.6%	5.9%	14.4%	9.8%	11.0%	7.7%	7.3%	15.4%
Maximum	129.7%	139.5%	119.1%	150.6%	128.3%	160.0%	230.1%	127.9%
Minimum	-130.7%	-112.0%	-105.8%	-123.3%	-125.0%	-133.0%	-135.9%	-156.6%
Standard deviation	46.9%	50.3%	42.7%	51.0%	45.4%	51.3%	58.0%	50.4%
Skewness	-0.16	0.33	-0.22	0.05	-0.15	-0.02	0.80	-0.68
Kurtosis	0.50	0.42	0.21	0.63	0.46	0.73	2.33	1.20
Jarque Bera	1.83	2.98	1.15	2.19	1.62	2.80	37.29***	15.32***

Number of observations	104	104	104	104	104	104	104	104

The findings show that all portfolios have positive annual mean returns. The highest mean returns are with portfolios formed of Grantham quality score (13,6%), D/P (11.6%), ROIC (11.4%), E/P (11.4%) and EBIT to EV (11.1%). The portfolios that are underperforming the market portfolio, which has annual mean return of %, are gross profitability (9.8%) and B/P (8.9%). In figure 5, cumulative returns for quality- and value portfolios are illustrated.

The highest yearly median returns are with OMX Helsinki Cap GI Index (15.4%) and portfolio formed based on Grantham quality score (14.4%) criteria, while the lowest yearly median returns are with gross profitability (5.9%) and B/P (7.3%). The highest maximum values are with B/P (230.1%), E/P (160.0%) and gross profitability (139.5%) while the lowest minimum values are with OMX Helsinki Cap GI Index (-156.6%), B/P (-135.9%) and E/P (-133.0%).

Portfolios formed of B/P, E/P and EBIT to EV ratios are the most volatile portfolios. They have annual standard deviations of 58.0%, 51.3%, 51.0% respectively. OMX Helsinki Cap GI Index has a standard deviation of 50.4%. The lowest standard deviations are with portfolios created Grantham quality score (42.7%) and D/P (45.4%).

Portfolios formed of Grantham quality score (-0.22), ROIC (-0.16), and D/P (-0.15) have little negative skewness, indicating that the tail is on the left side of the distribution. OMX Helsinki Cap GI Index has the highest negative skewness (-0,67). E/P has close to zero skewness, indicating a normal distribution. Positive skewness is found with portfolios constructed of B/P (0.80) and gross profitability (0.33).

Kurtosis values are ranging from 0.21 to 2.34 with the different portfolio creating strategies. Distributions with kurtosis less than three are said to platykurtic. Platykurtic distribution refers to a statistical distribution in which the excess kurtosis value is negative. This distribution will have thinner tails than a normal distribution, which results in fewer extreme value. The lowest value is with Grantham quality score (0.21) and gross profitability (0.42).

Jarque-Bera test is used to test if the distribution of returns is normally distributed. Portfolios formed of ROIC, gross profitability, Grantham quality score, EBIT to EV, D/P and E/P are normally distributed. Only portfolio formed of B/P ratio and OMX Helsinki Cap GI Index, is not normally distributed according to Jarque Bera test as the null hypothesis of normality distribution is rejected. The results are found to be statistically significant at the level of one percent. However, as it is assumed that the probability distribution is independent and identically distributed (IID) and the mean and standard deviation are finite, the sample mean gets approximately normally distributed as the number of observations increase. That is why, it is assumed that the whole distribution is normally distributed.

7.7.2 Descriptive statistics for combined quality and value portfolios

In tables 7 and 8, descriptive statistics for combined quality- and value portfolios are presented.

Table 7: Descriptive statistics for combined quality and value portfolios (1/2)

The table shows the descriptive statistics for combined quality and value portfolios. The mean, median, maximum, minimum and standard deviation are calculated based on the monthly returns, but the reported figures are annualized. Reported skewness and kurtosis are calculated based on the monthly returns. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Name	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitabilit y & B/P	ROIC & EBIT to EV	ROIC & D/P
Mean	12.3%	12.4%	11.3%	7.1%	11.6%	13.5%
Median	10.6%	15.9%	6.0%	-0.1%	12.7%	11.6%
Maximum	160.7%	138.1%	143.6%	219.4%	128.2%	121.9%
Minimum	-125.8%	-125.0%	-117.1%	-118.9%	-121.6%	-124.6%
Standard deviation	47.6%	43.3%	48.1%	53.5%	47.4%	45.8%
Skewness	0.04	-0.11	0.05	0.95	-0.21	-0.16
Kurtosis	0.84	1.08	0.43	2.65	0.47	0.48
Jarque Bera	3.65	6.02**	1.12	49.09***	2.02	1.78
Number of observation s	104	104	104	104	104	104

Table 8: Descriptive statistics for combined quality and value portfolios (2/2)

The table shows the descriptive statistics for combined quality and value portfolios. The mean, median, maximum, minimum and standard deviation are calculated based on the monthly returns, but the reported figures are annualized. Reported skewness and kurtosis are calculated based on the monthly returns. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Name	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
Mean	11.8%	11.4%	12.9%	12.2%	13.9%	10.9%
Median	10.2%	10.6%	11.7%	14.0%	12.0%	7.9%
Maximum	136.2%	151.7%	140.5%	121.0%	142.4%	127.9%
Minimum	-125.8%	-132.6%	-119.2%	-127.8%	-119.1%	-126.7%
Standard deviation	47.7%	51.3%	45.2%	43.4%	46.7%	46.1%
Skewness	-0.11	0.21	-0.01	-0.24	-0.05	0.02
Kurtosis	0.55	0.90	0.63	0.59	0.47	0.70
Jarque Bera	1.87	4.98*	2.14	2.88	1.32	2,60
Number of observations	104	104	104	104	104	104

The findings show that all combined quality- and value portfolios have positive annual returns. The best performing strategies are Grantham quality score combined with E/P (13.9%), ROIC combined with D/P (13.5%) and Grantham quality score combined with EBIT to EV (12.9%). Compared with stand-alone strategies, the best performing strategy based on annual returns is a combination of Grantham quality score and E/P ratio, followed by the stand-alone Grantham quality score strategy. After that, the best performing strategies are created by combining ROIC with D/P, Grantham quality score combined with EBIT to EV, Grantham quality score and gross profitability combined with D/P. The combined quality and value portfolio consisting of gross profitability and B/P has the lowest annualized mean return of all the strategies.

Median annualized returns are highest for combined portfolios gross profitability and D/P (15,9%), Grantham quality score and D/P (14.0%) and ROIC and EBIT to EV (12.7%) respectively, while the lowest returns are with gross profitability and B/P (-0.1%), gross profitability and E/P (6.0%) and Grantham quality score and B/P (7.9%). Maximum returns are highest with gross profitability and B/P (219.4%), gross profitability and

EBIT to EV (160.7%) and ROIC and B/P (151.7%) and minimum returns are lowest with ROIC and B/P (-132.6%) and Grantham quality score and D/P (-127.8%). Compared to stand alone strategies, the maximum return achieved is lower for combined quality and value portfolios and while the minimum return is also a bit lower.

The annual standard deviation values range from 43,4% to 53,5%. In general, it can be noted that these combined quality and value portfolios are quite similar to stand-alone strategies of quality- and value portfolios. The most volatile portfolios is a combination of gross profitability and B/P (53,5%), while the least volatile portfolio is a combination of Grantham quality score and D/P (43,4%). Grantham quality score as a stand-alone quality strategy has the lowest volatility (42,7%). The highest volatility is achieved with B/P (58.0%) as a stand-alone value strategy.

Little negative skewness is found with portfolios created of ROIC and E/P (-0.11), Grantham quality score (-0.01), Grantham quality score and E/P (-0.05), gross profitability and D/P (-0.11), ROIC and EBIT to EV (-0.21) and ROIC and D/P (-0.16), indicating that the tail is on the left side of the distribution. However, all the values are quite near zero, so the distribution is not that much affected of the negative skewness. Other combined portfolios have little positive skewness although, in general, the findings indicate that there is not much skewness found in the sample.

All combined quality and value portfolios have a kurtosis less than three, indicating that the distribution is platykurtic. However, looking at the Jarque-Bera's normality test almost all combined quality and value portfolios are distributed normally, except the portfolios created of ROIC and B/P, gross profitability and D/P and gross profitability and B/P. All in all, the sample seems quite normally distributed.

7.8 Yearly returns for quality-, value- and combined quality and value portfolios

In table 9, the annualized mean returns for quality- and value portfolios are illustrated year by year for years between 2011 and 2020.

Table 9: Yearly returns for quality- and value portfolios

The table presents yearly returns for quality- and value portfolios between years 2011-2020.

Year	ROIC	Gross profita-bility	Grantham quality score	EBIT TO EV	D/P	E/P	B/P	OMX Helsinki
2011-2012	-14.3%	-16.7%	-15.6%	-18.4%	-21.5%	-20.6%	-30.6%	-28.6%
2012-2013	23.8%	26.9%	27.6%	24.0%	21.0%	27.1%	16.3%	29.1%
2013-2014	19.8%	15.4%	20.4%	19.3%	21.8%	19.2%	18.4%	27.5%
2014-2015	16.9%	4.7%	18.8%	15.2%	15.2%	14.6%	16.4%	17.1%
2015-2016	7.8%	4.1%	4.3%	6.8%	3.6%	9.8%	9.5%	0.3%
2016-2017	25.7%	32.1%	32.1%	36.8%	34.1%	31.0%	42.8%	26.5%
2017-2018	-1.6%	-1.9%	12.0%	1.2%	8.8%	2.0%	1.4%	10.3%
2018-2019	-1.9%	-0.2%	-5.6%	-11.6%	-6.4%	-10.5%	-13.1%	-5.9%
2019-2020	23.0%	22.2%	27.0%	20.9%	24.4%	25.0%	12.0%	11.9%

In general, it can be seen that the long-only portfolios created of quality- and value portfolios went more or less to the same direction as the market index year by year. However, a closer look indicated that while in some years the market index has managed to outperform all of the quality- and value portfolios, in some years the market index has underperform all of its counterparts. It comes to the reader's attention that the best performing strategies between years 2011 and 2020, are the ones that have the most stable returns and that the returns are not that affected by market swings.

In table 10 and 11, the annualized mean returns for combined quality and value portfolios are presented year by year for years between 2011 and 2020.

Table 10: Yearly returns for combined quality and value portfolios (1/2)

The table shows yearly returns for combined quality and value portfolios between years 2011-2020.

Year	Gross & EBIT to EV	Gross & D/P	Gross & E/P	Gross & B/P	ROIC & EBIT to EV	ROIC & D/P
2011-2012	-15.3%	-17.9%	-16.8%	-19.1%	-18.4%	-13.4%
2012-2013	22.6%	23.4%	19.4%	17.3%	24.5%	20.8%
2013-2014	17.8%	16.9%	18.0%	8.3%	19.6%	16.4%
2014-2015	15.9%	17.1%	9.6%	9.7%	18.1%	19.1%
2015-2016	10.9%	7.0%	10.6%	3.7%	6.7%	7.7%
2016-2017	32.7%	33.6%	39.8%	39.3%	34.7%	35.0%
2017-2018	4.3%	5.7%	2.7%	2.0%	-2.6%	7.7%
2018-2019	-4.8%	-2.5%	-3.8%	-12.0%	-5.0%	-4.6%
2019-2020	22.8%	26.1%	16.4%	10.6%	22.1%	30.0%

Table 11: Yearly returns for combined quality and value portfolios (2/2)

The table shows yearly returns for combined quality and value portfolios between years 2011-2020.

Year	ROIC & E/P	ROIC &B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score& B/P
2011-2012	-17.9%	-22.9%	-13.2%	-17.6%	-14.4%	-19.9%
2012-2013	29.0%	23.0%	24.8%	21.9%	24.3%	21.4%
2013-2014	20.3%	16.1%	16.1%	16.2%	18.0%	16.7%
2014-2015	19.6%	15.4%	15.4%	15.9%	14.8%	15.0%
2015-2016	5.8%	7.9%	4.7%	5.6%	6.1%	9.6%
2016-2017	25.6%	37.8%	38.5%	33.7%	38.7%	33.5%
2017-2018	-3.1%	6.9%	6.4%	13.3%	9.5%	9.7%
2018-2019	-2.8%	-6.3%	-2.4%	-8.1%	-3.4%	-9.5%
2019-2020	26.9%	18.8%	23.5%	26.8%	27.6%	16.6%

Yearly returns from combined quality and value portfolios are quite similar to the returns that were found with quality- and value portfolios. All combined quality and value portfolios, quality portfolios and value portfolios went roughly to the same direction as the market index year by year. The sample period has been quite bullish and the same conclusion can be made for combined quality and value portfolios that in some years one portfolio have outperformed the other portfolios while in other years it’s the vice versa.

Looking at the mean returns for the whole period and yearly mean returns for quality portfolios, value portfolios and combined quality portfolios, one can draw a similar conclusion what Asness et al. (2015) made. Asness et al. (2015) found that portfolios constructed from different value metrics produce highly correlated returns. In this thesis, the same finding was made based on looking at the yearly returns for both quality- and value portfolios and combined quality and value portfolios.

Asness et al. (2015) found also that there is no value measure that outperforms all the value measures year by year and no single measure of value is continuously better than the others. Overall, an average of multiple metrics is usually the best. In this thesis, a similar conclusion is made based on the descriptive statistics and yearly mean returns. The best performing portfolios are created of Grantham quality score which is constructed based on three different financial variables and of different combinations of value and quality portfolios.

7.9 Correlation among monthly returns of quality portfolios, value portfolios and market portfolio

Looking at the yearly returns for both quality -, value – and combined quality and value portfolios, one can note these returns seem to be highly correlated. To be sure about the finding made in the previous chapter, in table 12 the correlations between monthly returns of the quality portfolios, value portfolios and market portfolio are showed.

Table 12: Correlation among monthly returns of quality portfolios, value portfolios and market portfolio.

The table 12 presents the correlations between monthly returns of the quality portfolios, value portfolios and market portfolio.

	OMX Helsinki	ROIC	Gross profitability	Grantham quality score	EBIT TO EV	D/P	E/P	B/P
OMX Helsinki	1.00							
ROIC	0.88	1.00						
Gross profitability	0.74	0.90	1.00					
Grantham quality score	0.86	0.94	0.87	1.00				
EBIT TO EV	0.85	0.95	0.88	0.93	1.00			
D/P	0.86	0.91	0.81	0.90	0.93	1.00		

E/P	0.86	0.95	0.88	0.92	0.97	0.93	1.00	
B/P	0.75	0.86	0.85	0.84	0.91	0.85	0.89	1.00

In the above table, all portfolios have significantly positive values ranging from 0.74 to 0.97. The quality portfolios, value portfolios and market portfolio seem to be positively correlated with each other. Cuthbertson and Nitzsche (2004) wrote a book called 'Quantitative Financial Economics'. In the book, they stated that the composition of any portfolio of so called 'value stocks' will considerably overlap considerably for most definitions of 'value'. In this thesis, the high correlations would suggest that this finding would concern also quality stocks. However, this thesis will not go in more depth of what is the exact composite of all portfolios.

8 METHODOLOGY

The methodology part will start by stating the research hypotheses. After that, the performance of value portfolios, quality portfolios and combined value- and quality portfolios, are examined further. The chosen risk-adjusted performance metrics are Sharpe ratio and Sortino ratio. Sharpe ratio is maybe the most famous risk-adjusted performance ratio. However, it has been criticized because it penalizes for very high positive returns. That is why this thesis uses another risk-adjusted performance ratio, namely Sortino ratio, which correct for the drawdowns that the Sharpe ratio have.

In addition, to these performance ratios, the Carhart's four factor model and Fama-French-five factor model is used as pricing models. The justification for using the Carhart's four factor model is that many famous profitable trading strategies are based on the three basic underlying anomalies, which are size value momentum. Lastly, Fama-French five-factor model is chosen because it has not been tested so much in these kinds of studies.

After introducing the empirical methods used in this thesis to capture the performance of the value- and quality stocks, the relevant statistical assumptions are made. Some statistical assumptions regarding the multiple regression models are stated. methodology chapter states the statistical hypotheses regarding our study. Last part of the reveals the model diagnostics of the Carhart's four factor model and Fama-French five-factor model.

8.1 Research hypothesis

This thesis aims to address the research question of whether value investing strategies perform better than quality investing strategies. Moreover, the objective is to test whether it is possible to combine value investing strategies with quality investing and yield superior results.

Considering the body of previous research on value investing, I assume that value portfolios have performed better than the overall market as well as growth portfolios based on the previous research. This view is based on the large previous literature list on the value premium and value anomaly internationally. The value premium has existed in most markets persistently. However, it is tough to define which one of these value ratios will get the best return. Based on my research I would agree with Pätäri and Leivo

(2015) who concluded that portfolios based on traditional value investment strategies vary over time and across markets.

Considering the body of previous research on quality investing, I would also assume that quality portfolios have outperformed the overall market. Quality investing has found more and more ground in the financial markets across the world in recent years. Additionally, especially in the USA value stocks has been underperforming its counterparts. That's why my research hypothesis is that quality investing strategies have been performing better than value investing strategies and the research hypothesis can states as per below:

H1: Quality investing strategies are expected to perform better than value investing strategies

Previous research on combining value investing strategies with quality investing strategies yields mixed results and it is not that well-researched topic. My view is similar to what Asness et al. (2015) had on formulaic based value investing. He found that there is no single value measure that outperforms the others year after year, but an average multiple of measures is typically the best. As the combined quality and value ratios are consisting of at least two ratios, I assume that combined quality and value portfolios are expected to yield superior returns compared to stand-alone strategies of quality portfolios and value portfolios. The second research hypothesis is stated as per below:

H2: Combining value investing strategies with quality investing strategies are expected to perform better than quality investing and value investing as stand-alone strategies

8.2 Risk-Adjusted Performance

Sharpe ratio and Sortino ratio are covered in more detail in the next section.

8.2.1 Sharpe ratio

Sharpe ratio is developed by William Sharpe (1966). Sharpe ratio is a common risk-adjusted performance ratio. It is calculated by taking the difference of the expected portfolio return and risk-free rate and (excess return) are divided by standard deviation, which is a measure of volatility. The formula looks as follows:

$$S_i = \frac{R_p - R_f}{\sigma_p} \qquad (10)$$

Where R_p is the monthly return of the portfolio R_p, R_f is the monthly risk-free rate and the σ_p is the standard deviation of monthly excess returns of portfolio p. The higher the ratio, the better.

The Ledoit-Wolf (2008) approach is used to test the statistical difference between the Sharpe ratios and the market. The same method was applied by Davydov et al. (2016). Negative excess returns can cause some problems with Sharpe ratio and that is why the following refinement is made for the denominator suggested by Israelsen (2005):

$$S_p = \frac{R_p - R_f}{\sigma_p^{(\frac{ER}{|ER|})}} \quad (11)$$

Where R_p is the return of the portfolio, R_f is the risk-free rate, ER is the excess return that is equal and σ_p is the standard deviation of the monthly excess returns of portfolio p.

Sharpe ratio has received some other criticism as well. Treynor, Priest, Fisher and Higgings (1968) criticized the Sharpe ratio because there exist factors that affect the returns but are not observable. Additionally, portfolio managers focus on diversification and not actively finding mispriced securities. Moreover, Sharpe ratio has been criticized because it penalized for very high positive returns (Goetzmann et al., 2007). Very high positive returns increase the risk as well. That is why this thesis wanted to include another performance ratio to increase credibility and to correct for the errors that the Sharpe ratio have. The chosen performance ratio is the Sortino ratio.

8.2.2 Sortino ratio

Sortino ratio is a variation of the Sharpe ratio, but it also considers the downside risk (1994, 1991). Instead of using the standard deviation as a risk measure, Sortino ratio uses the root-mean-square deviation below the minimum acceptable return. The minimum acceptable return that is used here is the risk-free rate. The formula for Sortino ratio is as follows:

$$SR_p = \frac{R_p - MAR}{\frac{1}{n}\sum_{R_p<MAR}\left(R_p - MAR\right)^2} \quad (12)$$

Where R_p is the return of the portfolio, MAR is the minimum acceptable return and n is the number of observations. The higher the ratio, the better.

8.3 Pricing models

The chosen pricing models are Carhart's four factor model and Fama-French five-factor model. These models are covered in more depth in the next section.

8.3.1 Carhart's four-factor model

Carhart (1997) uses a factor-based model that uses a time series regression and which is run separately on each portfolio. The formula is as follows:

$$R_{i,t} = \alpha_i + \beta_{i,M}RMRF_t + \beta_{i,S}SMB_t + \beta_{i,V}HML_t + \beta_{i,U}UMD_t + \varepsilon_{i,t} \qquad (13)$$

Where $R_{i,t}$ is the return on portfolio i at time t, RMRF, SMB, HML and UMD are the factor mimicking portfolio returns for market excess return, firm size, value and momentum respectively. $\varepsilon_{i,t}$ is the error term captured in the model.

The factor mimicking portfolios are constructed to have unit exposure to the factor concerned and zero exposure to all other factors (Brooks, 2019, pp 591-592). The abnormal market return is measured as the difference in returns between the chosen market index and the risk-free rate. SMB is a term that stands for to "small minus big" and it is the difference between a portfolio of small stocks and a portfolio of large stocks. HML is the difference between high book to market value ratios and low book to market value ratios. Value stocks are concerned as high book to market value stocks and growth stocks as low book to market value stocks. The fourth factor is the UMD ("up minus down") factor, which is generally known as the momentum factor. It is measured by the difference between the returns on the best performing stocks over the past year and the worst performing stocks over the past year.

8.3.2 Fama-French five-factor model

Fama and French (2015) developed a five-factor to describe stock returns by adding two new factors to their three-factor model. The two new factors are profitability and investment. The formula is as per below:

$$R_{i,t} = \alpha_i + \beta_{i,M}RMRF_t + \beta_{i,S}SMB_t + \beta_{i,V}HML_t + \beta_{i,R}RMW_t + \beta_{i,C}CMA_t + \varepsilon_{i,t} \qquad (14)$$

Where $R_{i,t}$ is the return on portfolio i at time t, RMRF, SMB, HML, RMW and CMA are the factor mimicking portfolio returns for market excess return, firm size, value, profitability and investment respectively. $\varepsilon_{i,t}$ is the error term captured in the model.

RMW which is referring to "robust minus weak" is measured as the difference between robust operating profitability and weak operating profitability. CMA which is referring to "conservative minus aggressive" is measured as the difference between conservative investment portfolios minus the aggressive investment portfolio. A more detailed description of how these different factors are created, can be found in Kenneth French website.

Fama and French (2015) find that the five-factor model outperforms the three-factor model because it has more explanatory power. The results suggest also that the HML is a redundant factor. High average returns are fully captured by exposures to RMRF, SMB, RMW and CMA. This would imply that a four-factor model that drops out the HML factor would perform as well as the five-factor model.

8.4 Relevant statistical assumptions

There are several assumptions regarding the linear regression model. The ordinary least squares (OLS) estimator should be BLUE (best linear unbiased estimator). Additionally, there are several assumptions concerning the error term and its interpretation. The most important statistical assumptions for this thesis are that there should be homoskedasticity and no autocorrelation. Multicollinearity which is that there is no linear association between the explanatory variables, is not a problem in this kind of studies.

Homoskedasticity which refers to a situation where the variance of each disturbance term is constant. The opposite is called heteroskedasticity. This assumption is necessary because higher variation for some observations implies lower explanatory power and less reliability. Additionally, this assumption makes sure that all observations are equally important. To account for that there is no heteroskedasticity in the regression's models Breusch-Pagan test against heteroskedasticity is performed. If the null hypothesis is rejected, the null hypothesis of homoscedasticity is rejected and the heteroskedasticity is assumed. No autocorrelation refers to a situation where the covariance between different error terms are zero. To test if the models suffer from autocorrelation, the Breusch-Godfrey test is applied. If the null hypothesis is rejected, the model suffers from autocorrelation.

8.5 Model diagnostics

In this section, the model diagnostics is revealed for the for the Carhart's four-factor model and Fama-French five-factor model for the quality portfolios, value portfolios and combined quality and value portfolios.

8.5.1 Quality- and value portfolios

In table 13, the model diagnostics for the Carhart's four factor model for quality- and value portfolios are presented.

Table 13: Model diagnostics for quality- and value portfolios for the Carhart's four-factor model

Table shows model diagnostics for quality- and value portfolios for Carhart's four-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Carhart's four-factor model	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P
Breusch-Pagan	7.85*	6.38	9.26*	6.01	2.71	8.23*	6.88
Breusch-Godfrey	0.11	1.21	2.12	2.38	2.66	2.27	0.22

For the quality- and value portfolios, only ROIC and E/P portfolios, have some indication that the models could suffer from heteroskedasticity as the null hypotheses are rejected at the ten per cent level. There is no evidence of the other regression models to suffer neither from heteroskedasticity nor autocorrelation.

In table 14, the model diagnostics for the Fama-French five-factor model for quality- and value portfolios are presented.

Table 14: Model diagnostics for quality- and value portfolios for the Fama-French five-factor model

Table shows model diagnostics for quality- and value portfolios for Fama-French five-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Fama-French five-factor model	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P
Breusch-Pagan	6.16	6.32	5.62	2.57	1.64	6.35	9.12
Breusch-Godfrey	0.02	1.09	2.44	1.81	1.83	1.57	0.00

It can be seen in the table, that none of the quality - and value portfolios are suffering from heteroskedasticity or autocorrelation as the null hypothesis cannot be rejected.

8.5.2 Combined quality and value portfolios

In tables 15 and 16, the model diagnostics for the Carhart's four-factor model for combined quality- and value portfolios are presented.

Table 15: Model diagnostics for combined quality and value portfolios for Carhart's four-factor model (1/2)

Table shows model diagnostics for combined quality and value portfolios for Carhart's four-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation.*, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Carhart's four-factor model	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitability & B/P	ROIC & EBIT to EV	ROIC & D/P
Breusch-Pagan	3.39	2.65	4.10	8.41*	7.52	5.63
Breusch-Godfrey	0.96	1.08	1.30	0.07	0.25	1.61

Table 16: Model diagnostics for combined quality and value portfolios for Carhart's four-factor model (2/2)

Table shows model diagnostics for combined quality and value portfolios for Carhart's four-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Carhart's four-factor model	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
Breusch-Pagan	8.73*	8.14*	11.37**	3.9	7.4	4.3
Breusch-Godfrey	1.3	1.9	1.0	4.73**	3.05*	0.7

Most of the combined quality- and value portfolios are neither suffering from heteroskedasticity nor autocorrelation. Only models suffering from heteroskedasticity are portfolios created of gross profitability and B/P, ROIC and E/P, ROIC and B/P and Grantham quality score and EBIT to EV. For the combined portfolios of gross profitability and B/P, ROIC and E/P and ROIC and B/P, the results are statistically significant at the ten per cent level, whereas the portfolio created of Grantham quality score and EBIT to EV are statistically significant at five per cent level. Portfolios created of Grantham quality score and D/P and Grantham quality score and E/P are suffering from autocorrelation as the null hypothesis of no autocorrelation is rejected at the ten per cent level for the portfolio of Grantham quality score and E/P and at five per cent level for Grantham quality score and D/P.

In table 17 and 18, the model for the five-factor model for combined quality and value portfolios are showed.

Table 17: Model diagnostics for combined quality and value portfolios for Fama-French five-factor model (1/2)

Table shows model diagnostics for combined quality and value portfolios for Fama-French five-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation.*, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Fama-French five-factor model	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitability & B/P	ROIC & EBIT to EV	ROIC & D/P
Breusch-Pagan	5.66	4.09	4.94	9.20	5.72	2.92
Breusch-Godfrey	0.89	0.53	0.93	0.00	0.22	2.15

Table 18: Model diagnostics for combined quality and value portfolios for Fama-French five-factor model (2/2)

Table shows model diagnostics for combined quality and value portfolios for Fama-French five-factor model. Breusch-Pagan test is used to test if the model suffers from heteroskedasticity and Breusch-Godfrey test is used detect if the model suffers from autocorrelation. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Model diagnostics for Fama-French five-factor model	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
Breusch-Pagan	5.42	7.43	7.34	2.02	2.36	4.41
Breusch-Godfrey	1.26	1.63	0.64	5.42**	2.71*	0.46

None of the regression models are suffering from heteroskedasticity. From autocorrelation, the combination of Grantham quality score and D/P, is suffering at the five per cent level. Combination of Grantham quality score and E/P is suffering from autocorrelation at ten per cent level.

8.5.3 Corrections made to avoid heteroskedasticity and autocorrelation

In general, the Fama-French five-factor models for quality-, value- and combined quality and value portfolios are suffering only minorly of both autocorrelation and heteroskedasticity, while in the Carhart's four-factor model for quality-, value- and combined quality and value portfolios, the portfolios are little more suffering from autocorrelation and heteroskedasticity. To avoid possible heteroskedasticity and autocorrelation problems, this thesis uses Newey West (1987) robust standard errors that use autocorrelation and heteroskedasticity consistent standard errors.

8.6 Statistical hypotheses

Based on the research questions, following statistical hypothesis can be addressed:

- H_{0a} = The regression alpha of the quality portfolios is not significantly different from zero

- H_{1a} = The regression alpha of the quality portfolios is significantly different from zero

- H_{0b} = The regression alpha of the value portfolios is not significantly different from zero

- H_{1b} = The regression alpha of the value portfolios is significantly different from zero

- H_{0c} = The regression alpha of the combined value and quality portfolios is not significantly different from zero

- H_{1c} = The regression alpha of the combined value and quality portfolios is significantly different from zero

These statistical hypotheses are applied to Carhart's four factor model and Fama-French five-factor model.

9 EMPIRICAL RESULTS

This chapter presents and discusses the empirical results. First, the risk-adjusted performance ratios are presented. These are followed by the two-sample t-test results, where regressions of different asset pricing models are presented and discussed.

9.1 Risk-adjusted performance ratios

Next this thesis will present and discuss the results for risk-adjusted performance ratios for quality-, value- and combined quality and value portfolios.

9.1.1 Risk-adjusted performance ratios for quality - and value portfolios

In table 19, the risk-adjusted performance ratios for quality- and value portfolios are presented.

Table 19: Risk-adjusted performance ratios for quality and value portfolios

The table shows risk-adjusted performance ratios for quality- and value portfolios. The performance ratios have been calculated based on monthly returns, but the reported figures are annualized. Statistically significant values are obtained with Ledoit-Wolf test which test the significance in Sharpe ratios by comparing it with the market. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Performance ratios	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P	Market
Sharpe ratio	0.242	0.195	0.321	0.219	0.256	0.222	0.154	0.204
Sharpe (Value - Market)	0.038	-0.010	0.116**	0.014	0.052	0.018	-0.051	-
Sortino ratio	0.407	0.345	0.565	0.371	0.432	0.374	0.274	0.306

All mean Sharpe ratios are positive. Most of the mean Sharpe ratios for quality- and value portfolios are higher than the one of market portfolio's. Gross profitability (0.195) and B/P (0.154) are only lower than the market portfolio (0.204). The highest Sharpe ratio is with Grantham quality score (0.321), followed by D/P (0.256) and ROIC (0.242), indicating that these portfolios are the best performing portfolios.

However, according to the Ledoif-Wolf (2008) test of significance, only Grantham quality score is performing better than the market. The results are statistically significant at the level of five per cent. These results suggest that Grantham quality score is offering a higher excess return per single unit of total risk. Similar results about the performance of quality- and value portfolios are found based on the Sortino ratio. The highest Sortino ratios are found with Grantham quality score (0.565), D/P (0.432) and ROIC (0.407) while the lowest Sortino ratios are with B/P (0.274) and the market portfolio (0.306)

9.1.2 Risk-adjusted performance ratios for combined quality and value portfolios

In table 20 and 21, the risk-adjusted performance ratios for combined quality and value portfolios are illustrated.

Table 20: Risk-adjusted performance ratios for combined quality and value portfolios (1/2)

The table shows risk-adjusted performance ratios for combined quality and value portfolios. The performance ratios have been calculated based on monthly returns, but the reported figures are annualized. Statistically significant values are obtained with Ledoit-Wolf test which test the significance in Sharpe ratios by comparing it with the market. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Performance ratios	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitability & B/P	ROIC & EBIT to EV	ROIC & D/P
Sharpe ratio	0.258	0.287	0.234	0.133	0.245	0.296
Sharpe (Value - Market)	0.054	0.083	0.030	-0.071	0.041	0.092*
Sortino ratio	0.457	0.496	0.408	0.244	0.408	0.516

Table 21: Risk-adjusted performance ratios for combined quality and value portfolios (2/2)

The table shows risk-adjusted performance ratios for combined quality and value portfolios. The performance ratios have been calculated based on monthly returns, but the reported figures are annualized. Statistically significant values are obtained with Ledoit-Wolf test which test the significance in Sharpe ratios by comparing it with the market. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively.

Performance ratios	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
Sharpe ratio	0.248	0.222	0.286	0.281	0.297	0.236
Sharpe (Value - Market)	0.045	0.018	0.082	0.077	0.093*	0.032
Sortino ratio	0.422	0.389	0.511	0.481	0.532	0.407

Quite similar results can be found with risk-adjusted performance ratios for combined quality and value portfolios than for stand-alone strategies for quality- and value portfolios. Statistically significant results can only be found with combinations of Grantham quality score and E/P (0.297) and ROIC and D/P. These findings are statistically significant at the ten per cent level. The lowest Sharpe ratios are found with combinations of gross profitability and B/P (0.133) and ROIC and B/P (0.222)

Similar conclusions about the performance of the combined quality and value portfolios can be drawn on the Sortino ratio. Overall, the results suggest that the best performing combined quality and value portfolios are created by combining Grantham quality score and E/P, ROIC and D/P, gross profitability and D/P, Grantham quality score and EBIT to EV and Grantham quality score and D/P together. These combined quality and value portfolios are performing better than the stand-alone strategies for quality- and value portfolios with the exception of the Graham quality score which is the highest performing strategy of all.

9.2 Asset pricing models

Asset pricing models that are examined in this paper are Carhart's four-factor model and Fama-French five-factor model. Results for each of these asset pricing models are presented and examined in more depth. First, the results of the quality- and value portfolios are discussed for each of the asset pricing models. Second, the results of the combined quality and value portfolios are covered and then compared with the results of the quality- and value portfolios.

9.2.1 Results for quality and value portfolios

In this section, results for the quality- and value portfolios are examined further when different asset pricing models are used.

9.2.1.1 Carhart's four factor model

In table 22, the results from Carhart's four factor model for quality - and value portfolios are examined. Compared to Fama-French three factor model, one additional factor is added to the regression model, which is the momentum factor.

Table 22: Results from Carhart's four factor model for quality - and value portfolios

The table shows factor loadings for the Carhart four-factor model for quality- and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Carhart's four-factor model	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P
alpha	0.0210	0.0100	0.0646***	0.0204	0.0447**	0.0180	0.0041
beta	0.7947***	0.6989***	0.7081***	0.8335***	0.7626***	0.8396***	0.8106***
SMB	0.024**	0.0042***	0.0022**	0.0023*	0.0017	0.0027**	0.0056***
HML	-0.0011	-0.0011	-0.0003	0.0001	0.0005	0.0003	0.0011
UMD	0.0003	0.0005	-0.0006	0.0001	-0.0080	0.0005	-0.0004
R2	0.783	0.578	0.750	0.726	0.758	0.743	0.602
Adjusted R2	0.774	0.561	0.740	0.715	0.748	0.732	0.586

All quality- and value portfolios are producing positive alpha values although portfolios formed of Graham quality score and D/P ratio are only producing statistically significant alpha values. Graham quality score has an annual alpha value of 6.46% which is statistically significant at one per cent level and D/P ratio has an annual alpha value of 4.47% which is statistically significant at the 5 per cent level. ROIC (2.1%) and EBIT to EV (2.04%) portfolios are the next highest annual alpha values but these results are not statistically significant. The lowest alpha value is found with value portfolio constructed of B/P ratio.

All beta values are less than one, indicating that all portfolios fluctuate less than the market on average. The lowest betas are with gross profitability (0.699) and Graham quality score (0.708). The highest beta values are with E/P and (0.840) and EBIT to EV (0.834). All beta values are statistically significant at one per cent level.

Looking at the SMB, HML and UMD factors, only SMB factor is producing statistically significant results. Portfolios formed of B/P (0.56%) and gross profitability (0.42%) are producing statistically significant results at one per cent level. Moreover, portfolios formed of E/P (0.27%), ROIC (0.24%) and Graham quality score (0.22%) are yielding significant results at five per cent level. At ten per cent level, even EBIT to EV ratio (0.23%) is generating positive significant results. Overall, small stocks seem to generate higher returns compared larger stocks.

None of the HML and UMD values are statistically significant, indicating that there is no difference returns on between high- and low book to market value stocks and returns on the best performing stocks over the past year and the worst performing stocks. The outperformance of quality- and value portfolios can be explained by the market and the size factor but not with the value or momentum factor.

R-squared values are ranging from 0.578 to 0.758. ROIC has the highest R-squared while the lowest R-squared is with gross profitability. In general, the explanatory power in the model is quite high. The author of this thesis was more interested to look at the adjusted R-squared as it considers degrees of freedom correction. The highest adjusted R-squared values are with ROIC (0.774) and D/P (0.748) and the lowest with gross profitability (0.561) and B/P (0.586). Overall, the R-squared and adjusted R-squared are producing quite similar results although the R-squared values are little higher than adjusted R-squared values due to the fact that adjusted R-squared is correcting for degrees of freedom.

9.2.1.2 Fama-French five-factor model

In table 23, the results from Fama-French five-factor model are presented for the quality- and value portfolios. For the classic Fama- French three-factor to additional factors are included. The two new factors are profitability and investment.

Table 23: Results from Fama-French five-factor model for quality and value portfolios

The table shows factor loadings for the Fama-French five-factor model for quality – and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Fama-French five-factor model	ROIC	Gross profitability	Grantham quality score	EBIT to EV	D/P	E/P	B/P
alpha	0.0387*	0.0279	0.0750***	0.0353	0.0578***	0.0414*	0.0194
beta	0.7780***	0.6874***	0.6806***	0.8138***	0.7337***	0.8120***	0.7835***
SMB	0.0020*	0.0038**	0.0018	0.0018	0.0012	0.0022	0.0051**
HML	-0.0044**	-0.0046*	-0.002	-0.002	-0.003*	-0.0036*	-0.002
RMW	-0.0052**	-0.0049	-0.0045**	-0.0043	-0.0066***	-0.0063***	-0.006
CMA	0.0001	0.0008	-0.0018	-0.0014	0.0006	-0.0002	-0.0003
R2	0.793	0.584	0.761	0.733	0.773	0.755	0.611
Adjusted R2	0.782	0.563	0.749	0.72	0.762	0.742	0.591

Portfolios formed of Graham quality score and D/P ratio are generating statistically significant results at one per cent significance level. Graham quality score is yielding an annual alpha of 7.5% and D/P ratio is yielding a annual alpha of 5.78%. Additionally, portfolios of formed of ROIC (3.87%) and E/P (4.14%), are producing significant alphas at the 10 per cent level. When comparing Fama-French five-factor model to Carhart's four factor model, it can be seen that alpha values are little higher and more significant. For example, while the portfolios formed of E/P and ROIC are statistically insignificant in the Carhart's four factor model, they are statistically significant in the Fama-French five-factor model. Yet again all the betas are statistically significant at the one per cent level. The beta values are ranging from 0.681 to 0.812. In general, compared to Carhart's four-factor model, these betas are slightly lower.

Looking at the SMB, HML; RMW and CMA factors, statistically significant results are found with SMB, HML and RMW factors. For SMB factors, statistically significant values are found with portfolios formed of B/P (0.51%), gross profitability (0.38%) and ROIC (0,20%). Results for gross profitability and B/P are statistically significant at 5 per cent level while the results for ROIC are statistically significant at the level of 10%. For these portfolios, there are evidence of small stocks outperforming the large stocks.

For the HML factors, there are evidence of statistical significance, too. All the HML factors are negative. Portfolio formed based on ROIC yielded a value of -0.44% and which is statistically significant at the 5 per cent level. Portfolios created based on gross profitability and E/P, which have values of -0.46% and -0.36%, are statistically significant at the level of 10 per cent. Negative values on HML loading is indicating that low book to market value stocks are outperforming the high book to market value stocks. In general, growth stocks are considered stocks that have low book to market value ratios.

There can be found statistically significant results with RMW factor loadings, too. Portfolio formed of E/P (-0.63%) and D/P (-0.66%) are generating statistically significant results at the one per cent level, while portfolios formed of ROIC (-0,52%), Grantham quality score (-0,45%) are generating statistically significant results at the five percentages level. A negative loading on the RMW factor, are implicating that a weak operating profitability are yielding superior returns compared robust operating profitability. CMA factor values are all statistically insignificant, implying that there is no difference between conservative investment portfolio and aggressive investment portfolio.

R-squared values are ranging from 0.584 to even as high as 0.793. Adjusted R-squared values are ranging from 0.563 to 0.782. These findings implicate, that the Fama-French five-factor model has slightly higher explanatory power than the Carhart four-factor model. These finding suggest that the two added variables, profitability and investment, should be included in the model.

9.2.2 Results for combined value and quality portfolios

In this section, results for the combined quality and value portfolios are examined further when different Carhart's four-factor model and Fama-French five-factor model are used. These results are compared with results from quality- and value portfolios.

9.2.2.1 Carhart's four-factor moodel

In table 24 and 25, the results from Carhart's four factor model for combined quality and value portfolios are presented.

Table 24: Results from Carhart's four-factor model for combined quality and value portfolios (1/2)

The table shows factor loadings for the Carhart four-factor model combined quality and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Carhart's four - factor model	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitability & B/P	ROIC & EBIT to EV	ROIC & D/P
alpha	0.0263	0.0478**	0.0292	-0.0043	0.0252	0.0467**
beta	0.6280***	0.7118***	0.7369***	0.6847***	0.7987***	0.7746***
SMB	0.0025**	0.0027**	0.0022	0.0048**	0.0024*	0.0018
HML	-0.0001	-0.0008	-0.0007	-0.0006	-0.0002	-0.0005
UMD	0.0005	-0.0004	0.0002	-0.0004	0.0004	0.0004
R2	0.706	0.744	0.638	0.497	0.778	0.770
Adjusted R2	0.694	0.734	0.623	0.477	0.769	0.761

Table 25: Results from Carhart's four-factor model for combined quality and value portfolios (2/2)

The table shows factor loadings for the Carhart four-factor model combined quality and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Carhart's four - factor model	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
alpha	0.0271	0.0273	0.0501**	0.0467**	0.0579***	0.0347
beta	0.8034***	0.8173***	0.7674***	0.7328***	0.7730***	0.7204***
SMB	0.0022*	0.0034**	0.0017	0.0016	0.0024*	0.0040***
HML	-0.0005	-0.0000	-0.0006	-0.0002	-0.0000	0.0000
UMD	0.0003	-0.0003	-0.0004	-0.0004	-0.0002	-0.0007
R2	0.772	0.711	0.761	0.758	0.747	0.712
Adjusted R2	0.763	0.699	0.751	0.749	0.736	0.700

Similar results are found for combined quality and value portfolio for Carhart's four-factor model than for quality- and value portfolios. All alpha values for combined quality and value portfolios are positive, except the combination of gross profitability and B/P (-0.43%). The highest combinations of quality and value are found by combining Grantham quality score and E/P (5.79%), Grantham quality score and EBIT to EV (5.01%), gross profitability and D/P (4.78%), ROIC and D/P (4.67%) and Grantham quality score and D/P (4.67%). While the combination of Grantham quality score and E/P produced statistically significant results at the one per cent level, the other combinations yielded statistically significant results at five per cent level.

When comparing results from Carhart's four-factor model for combined quality and value portfolio with results from Carhart's four factor model for quality- and value portfolios, the best performing strategy is a stand-alone quality portfolio constructed of Grantham quality score. After that, the best performing portfolios are constructed of combinations of quality and value which have statistically significant results. After that, the best performing portfolio is constructed of D/P which is a value ratio. While only one of three quality ratios' is producing statistically significant results and only one of four value ratios produces statistically significant results, there are numerous combined quality and value portfolios that produced statistically significant alpha values. In fact, five out of twelve combined quality and value ratios produced statistically significant values.

The betas from Carhart's four-factor model for the combined quality and value portfolios are yet again all statistically significant at the level of one. Betas are ranging from 0.628

to 0.817, indicating that the combinations of quality and value are fluctuating less than the market on average and the beta values are similar to those created of quality- and value portfolios.

Moving on to the SMB factor loading, all values are positive and some of the values are statistically significant. At ten per cent significance level, portfolios constructed of ROIC and E/P (0.22%), Grantham quality score and E/P (0.24%) and ROIC and EBIT to EV (0.24%) are producing statistically significant results. At five per cent significance level, combinations of ROIC and B/P (0.34%), gross profitability and EBIT to EV (0.25%), gross profitability and D/P (0.27%) and gross profitability and B/P (0.48%) are producing statistically significant results. Combination of Grantham quality score and B/P is producing statistically results at one per cent level. Overall, both the stand-alone strategies of quality- and value portfolios and combinations of quality and value for Carhart's four-factor model is yielding quite similar results for SMB factor loadings, as all the loadings are positive. These results indicate that on average small stocks are outperforming large stocks.

Additionally, all HML and UMD factor loadings for combined quality and value ratios are statistically insignificant, indicating that there is no difference between the performance of high book to market stocks and low book to market stocks and the returns on the best performing stocks over the past year and the returns on the worst performing stocks. This same finding was made for quality- and value portfolios. Finally, the R-squared values are ranging from 0.497 to 0.778. The adjusted R-squared values are ranging from 0.477 to 0.769. The predicting power of returns are quite the same for combined quality and value portfolios than for stand-alone strategies of quality portfolios and value portfolios.

9.2.2.2 Fama-French five-factor model

In tables 26 and 27, the results from Fama-French five-factor model for combined quality and value portfolios are illustrated.

Table 26: Results from Fama-French five-factor model for combined quality and value portfolios (1/2)

The table shows factor loadings for the Fama-French five-factor model for combined quality and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Fama-French five-factor model	Gross profitability &EBIT/EV	Gross profitability & D/P	Gross profitability &E/P	Gross profitability & B/P	ROIC & EBIT to EV	ROIC & D/P
alpha	0.0403*	0.0598***	0.0452	0.0147	0.0416*	0.0679***
beta	0.6201***	0.6948***	0.7206***	0.6570***	0.7858***	0.7535***
SMB	0.0022*	0.0023*	0.0017	0.0043**	0.0020	0.0013
HML	-0.0033*	-0.0040**	-0.0037*	-0.0052*	-0.0030	- 0.0045***
RMW	-0.0035*	-0.0051**	-0.0049*	-0.0077*	-0.0044**	-0.0061***
CMA	0.0001	0.0014	0.0001	0.0013	0.0001	0.0006
R2	0.712	0.757	0.647	0.515	0.786	0.785
Adjusted R2	0.697	0.745	0.629	0.490	0.775	0.774

Table 27: Results from Fama-French five-factor model for combined quality and value portfolios (2/2)

The table shows factor loadings for the Fama-French five-factor model for combined quality and value portfolios. The reported alpha values have been calculated based on monthly returns, but the reported figures are annualized. *, ** and *** indicate statistical significance at 10%, 5%, 1% levels, respectively. The standard errors are reported using Newey and West procedure.

Fama-French five-factor model	ROIC & E/P	ROIC & B/P	Grantham quality score & EBIT to EV	Grantham quality score & D/P	Grantham quality score & E/P	Grantham quality score & B/P
alpha	0.0462**	0.0419*	0.0616***	0.0656***	0.0732***	0.0449**
beta	0.7836***	0.7908***	0.7453***	0.7033***	0.7483***	0.6939***
SMB	0.0017	0.0028*	0.0013	0.0010	0.0019	0.0036**
HML	-0.0035*	-0.0027	-0.0031	-0.0041**	-0.0029	-0.0020
RMW	-0.005**	-0.0054*	-0.0049**	-0.0071**	-0.0056**	-0.0048**
CMA	-0.0008	-0.0011	-0.0002	-0.0001	-0.0006	-0.0010
R2	0.783	0.722	0.771	0.782	0.760	0.721

Adjusted R2	0.772	0.707	0.759	0.771	0.747	0.707

Fama-French five-factor model for combined quality and value portfolios are producing interesting results. Combining Grantham quality score with E/P, D/P and EBIT to EV are producing annual alphas of 7.32%, 6.56% and 6.16% respectively and combinations of gross profitability and D/P and ROIC and D/P are producing annual alphas of 5.98% and 6.79% respectively. All these results are statistically significant at one per cent level. At five per cent level, combinations of ROIC and E/P (4.62%) and Grantham quality score and B/P are producing statistically significant results. Furthermore, at ten per cent level, even combinations of gross profitability and EBIT to EV (4.03%), ROIC and EBIT to EV (4.16%) and ROIC and B/P (4.19%) are producing statistically significant results. In total 10 out 12 combined quality ratios are producing statistically significant results.

When comparing the results from combined quality and value portfolios to stand-alone strategies of quality portfolios and value portfolios, the best performing strategy is yielded with Grantham quality score which is a quality ratio. However, after that there comes a bunch of combined quality and value ratios that produces statistically significant alpha values. It can be also noted that the Fama-French five-factor model is producing little higher alpha values than the Carhart's four factor model.

The betas from the five-factor model for the combined quality and value portfolios are all statistically significant at the level of one. Betas are ranging from 0.620 to 0.791. The results are quite similar than the previous ones. When comparing the combined quality and value portfolios with Fama-French five factor model to Carhart's four-factor model, the betas are slightly lower.

Yet again, all SMB factor loadings are positive and some even statistically significant, indicating that the small cap stocks are outperforming large caps stocks on average. At five per cent level, combinations of Grantham quality score and B/P (0.36%) and gross profitability and B/P (0.43%) produced statistically significant factor loadings. Additionally, at ten per cent level, combinations of gross profitability and EBIT to EV (0.22%), gross profitability and D/P (0.23%) and ROIC and B/P (0.28%) produced statistically significant results.

For the HML factors for combined quality and value ratios, there are evidence of statistical significance, too. All the HML factors are negative. This same finding was found with quality- and value portfolios for Fama-French five-factor model. Combination of ROIC and D/P (-0.45%), produced statistically significant results at one per cent level. At five per cent level, gross profitability and D/P (-0.40%) and Grantham quality score and D/P (-0.41%) yielded statistically significant results. At ten per cent level, combinations of gross profitability and EBIT to EV (-0.33%), gross profitability and B/P (-0.52%), gross profitability and E/P (-0.37%) and ROIC and E/P (-0.35%) resulted in statistically significant results. Overall, it can be noted that low book to market stocks are generating better results on average than high book to market stocks.

Negative factor loadings are found with RMW, too. A negative loading on the RMW factor, are implicating that a weak operating profitability are yielding superior returns compared robust operating profitability. Both the combined quality and value portfolios and quality- and value portfolios for Fama-French factor model had negative RMW factors. All combined quality and value ratios are statistically significant. None of the CMA factor loadings are statistically significant for combined quality and value portfolios, implicating that there is no difference conservative portfolio and aggressive investment portfolio. The same finding was made with Fama-French five-factor model for stand-alone strategies for quality portfolios and value portfolios.

Lastly, R-squared values are ranging from 0.515 to 0.786, while the adjusted R-squared values are ranging from 0.490 to 0.775 for combined quality and value portfolios. Compared with Carhart's four-factor model, the Fama-French five-factor model has slightly more explanatory power and in that sense the model should be preferred over the Carhart's four-factor model. Additionally, the Fama-French five-factor model produced more statistically significant results.

10 DISCUSSION

This chapter discusses and compares the empirical results to related findings in previous research. In addition, discussion around the research question is made. Furthermore, potential empirical problems affecting the results are discussed and suggestions for future research in value investing, quality investing and combined quality and value investing are made.

10.1 Results discussion and previous findings

The results are discussed in this section and compared to previous findings. Firstly, the quality investing, value investing and combined quality and value investing results are discussed and compared to previous findings. Secondly, the asset pricing models that are used in this study are discussed and compared with previous findings.

10.1.1 Risk-adjusted performance ratios for quality -, value – and combined quality and value portfolios

This thesis used two different risk-adjusted performance ratios, namely Sharpe ratio and Sortino ratio. All of the quality portfolios, value portfolios and combined quality and value portfolios had both positive Sharpe ratios and Sortino ratios. However, according to Ledoit-Wolf test for significance in difference in Sharpe ratios, only Grantham quality score and combinations of ROIC and D/P and Grantham quality score and E/P produced some statistically significant results. The best performing strategy is achieved when Grantham quality score is used as criterion to form the portfolio. In that sense, quality investing strategies are outperforming its counterparts.

Grantham quality score and combinations of quality and value portfolios have not been previously tested in the Finnish market as far the author of this thesis is aware of. While this thesis found none of the value ratios based on the Sharpe ratio to be statistically significant, Leivo and Pätäri found that value portfolios created based on D/P and E/P ratios are statistically significant and Davydov et al. (2016) found also that statistically significant results is yielded with E/P ratio. Neither Novy-Marx (2014) nor Lalwani et al. (2018) used statistical significance tests for Sharpe ratios.

10.1.2 Asset pricing models

This thesis used two different asset pricing models, namely Carhart's four-factor model and Fama-French five-factor model. All statistical hypotheses were applied to both Carhart's four-factor model and Fama-French five-factor model. The statistical hypotheses were addressed around the regression alpha. Discussion around the regression alphas of quality-, value– and combined quality and value portfolios and previous findings will be made. Additionally, it is of interest to reveal which one of the two asset pricing models have higher explanatory power. That is why, discussion around which of the two models perform better are made and compared to previous studies.

10.1.2.1 Regression alphas for quality -, value – and combined quality portfolios

Quality investing strategies that were used in this thesis are Grantham quality score, gross profitability and ROIC. Grantham quality score produced statistically significant alphas and was the best performing quality ratio. Grantham quality score have not been previously tested in the Finnish stock market. Nonetheless in the Indian stock market, Lalwani and Chakraborty (2018) found evidence of its superior performance. ROIC had little evidence of yielding extraordinary results. Furthermore, quality investing strategy based on ROIC, have only little evidence of outperforming the Finnish overall market in this study. Comparing the past performance of ROIC, for example, Novy-Marx found no outperformance of this specific ratio in the U.S. stock market. Additionally, this study did not find statistically significant results for gross profitability metrics and in general it was performing worse than some value ratios and combined quality and value ratios. However, Lalwani and Chakraborty (2018) discovered that gross profitability is yielding extraordinary results. Moreover, Novy-Marx found in the U.S. that gross profitability is generating significant excess returns.

Value investing strategies that were used in this thesis were D/P, E/P, EBIT to EV and B/P ratios. The best performing value portfolio was achieved with D/P ratio. Similar results can be found in the previous value investing literature in the Finnish stock market. D/P ratio has been the best performing individual value investing strategy according to Leivo and Pätäri (2009) in the previous value investing literature. Other value ratios that performed well were E/P and EBIT/EV. E/P and EBIT to EV performed quite similarly in comparison with the quality ratio ROIC. The worst performing metrics was B/P. Overall, these results are aligned with findings made by Leivo and Pätäri (2009) and Davydov, Tikkanen and Äijö (2016).

Previous studies of combining quality with value, have focused on combining quality investing strategies with B/P ratio and combining ROIC to EBIT to EV. For example, Novy-Marx (2014) discovered that by combining quality with value, better risk-return relationships are found while Lalwani and Chakraborty (2018) find out that by combining quality with value, the performance decreases. Greenblatt (2006, 2010) found that the combination of EBIT to EV and ROIC yielded extraordinary performance. As far as the author of this thesis is aware, no previous studies have combined quality ratios of Grantham quality score, gross profitability and ROIC with value ratios such as E/P, D/P and EBIT to EV (with the exception of ROIC). Moreover, combinations of quality and value strategies, have not been previously tested in the Finnish stock market.

This thesis is more aligned with Novy Marx's (2014) findings who found that combining quality with value yields better risk-return relationships. 10 out of 12 combined quality and value ratios produced statistically significant alpha values based on the Fama-French five-factor model. The best performing combined quality and value ratios were created based combinations of Grantham quality and E/P, ROIC and D/P and Grantham quality score and D/P. Overall, it seems that by combining quality with value, the alphas become higher.

10.1.2.2 Carhart's four-factor model or Fama-French five-factor model

First, the more promising results were found with the Fama-French five-factor model compared to the Carhart's four-factor model. Fama-French five-factor model had higher and more statistically significant alphas than the Carhart's four-factor model. Additionally, it had slightly higher explanatory power than the Carhart's four-factor model. Moreover, while Fama-French five-factor model had significant values also with factors SMB, HML, RMW and market portfolio, Carhart's four -factor model had only significant results with the SML and market portfolio. Momentum factor had only insignificant results.

The Fama-French five factor model is not widely used in this kind of studies and that is why these results are especially of interest. For example, Leivo and Pätäri used a two-factor model, while Davydov, Tikkanen and Äijö (2014) used CAPM and Carhart's four-factor model. In this thesis, Comparing the results with findings made by Davydov, Tikkanen and Äijö (2014), they had also positive factor loadings on the SMB. Fama-French (2015) found that the results from the five-factor model suggested that the HML factor is a redundant factor. This study did not find the HML as a redundant factor. This study found out all HML factor loadings are negative while some are even statistically significant, indicating that low book to market stocks are generating better results than high book to market stocks.

10.2 Discussion around the research questions

This thesis had two research questions. The first one was that quality investing strategies are expected to perform better than value investing strategies in the Finnish stock market. The other one was that combining value investing strategies with quality investing strategies are expected to perform better than the quality investing strategies and value investing strategies as stand-alone strategies.

This study contributes to the large literature stream for value - and quality premium to exist. In general, all the value-, quality- and combined quality and value portfolios, outperformed the overall market in the Finnish stock market. More tricky question is to answer the question of which one of the three different strategies are the best performing as some value portfolios, quality portfolios and combined quality and value portfolios are performing better than the others and vice versa? One can note also that all quality- value and combined quality and value portfolios have produced some statistically significant values.

The best performing portfolio of all strategies was achieved with Grantham quality score, which is a quality strategy. However, quality strategies consisting of gross profitability and ROIC, did worse than all the combined quality and values portfolios, with the exception of combination of gross profitability and B/P. In fact, combinations of quality and value yielded quite promising results as there were many combinations of quality and value portfolios that produced statistically significant results. One may ask what connection does the Grantham quality score and combinations of quality and value portfolios have? The finding that I made was that the best performing strategies are a combination of multiple values as Grantham quality score is consisting of three different financial variables whereas the combinations of quality and value are consisting of two different financial variables. Similar finding was made by Asness et al. (2015) who concluded that an average of multiple measures is the best. Additionally, no measure outperforms all the other measures year after year.

Asness et al. (2015) stated also that portfolios from different measures yield highly correlated returns. According to the descriptive statistics, risk adjusted-performance ratios and used capital asset pricing models in this thesis, similar conclusions can be made. All of the quality-, value- and combined quality and value portfolios produce somewhat similar results and the portfolio returns for different strategies seem to be correlated. The questions that arises are that are the portfolios constructed of different quality -, value – and combined quality and value portfolios consisting of mainly same companies and how these different strategies are distinguished? Is there high overlap between the different portfolios? Although it is self-evident that both value premium, quality premium and combined quality and value premium exist, is it criteria that can be solely used to construct a portfolio or is further fundamental analysis needed?

All in all, if one would need to answer the research questions, the ranking would be as follows: overall combined quality and value investing strategies are performing better than stand-alone strategies of quality investing and value investing and generally quality investing strategies are outperforming the value investing strategies.

10.3 Discussion of potential problems

The first issue that I will discuss is the database used in this thesis. Data was retrieved from Thomson Reuters Datastream database and Thomson Reuters Worldscope database. To start with, few companies were dropped out because they had no financial variable data in the Worldscope database. Secondly, few companies were excluded from the sample as the companies did not have historical stock prices available, even if the companies had other financial data. Because some companies were excluded from the sample due to lack of financial data, it can have an impact on the results. Luckily, there were not many Finnish companies that had to be excluded from the sample because of lack of financial data and the sample should not suffer from survivorship bias.

Another potential issue for this study is that it uses readily available European factors from Kenneth French website for the factor models. Even though the European factors should be quite similar related to the Finnish stock market factors, they are sub-optimal when compared to the domestic factors. The results can be affected from this. Additionally, no transaction costs have been included in this thesis. In reality, transaction costs are generated when stocks are bought and sold so the results can be overly optimistic. The transaction costs were not included in this study because this study is more theoretical, and it would be hard to calculate the correct transaction fee percentages. Further research could also focus on what should be the correct amount of transaction fees in the 21st century.

This study is concentrating on the period after financial crisis. It is notable, that the risk-free rate has been negative for some time. This can affect the results, too. Additionally, the time period could be lengthened.

10.4 Proposals for future research

After the financial crisis, there has been evidence of underperformance of value stocks in the U.S., the evidence is completely reverse in the Finnish stock market according to this study. For further research, it would be interesting to examine what effect have the negative interest rates had had on value – and quality investing. This research could be extended into the other Nordic countries as well. For example, there is not much of evidence from the Swedish stock markets and how have the value- and quality investing strategies performed there.

Additionally, more research on quality investing strategies and combined quality and value investing strategies could be made in the Finnish stock market. For example, other quality strategies that could be tested are Graham G-score, Piotroski's F-score, Sloan's Earnings quality and Defensive investor. Additionally, quality investing could be even related to non-financial indicators such as sustainable practices. Moreover, combinations of quality and value could be constructed so that they consisted of numerous combinations of quality- and value metrics.

One interesting topic that could be researched more is whether value investing, quality investing and combined quality and value investing are truly generating superior returns in the Finnish stock market or is it just a result of formulaic based investing, which is linked, for example, with misidentifications in the accounting numbers and the fundamental economic developments? In addition, it would be interesting to research more in depth what kind of correlations these different investing strategies have and do the portfolios highly overlap each other? Based on my research the different quality-, value- and combined quality portfolios are yielding returns that are each year somewhat the same.

Moreover, the Fama-French five factor model could be researched more in the Finnish stock market. Incorporating new asset pricing models into the Nordic Markets could be of interest as well. Asness et al. (2018) introduced a new quality factor, namely quality-minus-junk factor, which consists of safe, profitable and growing companies that can account for why firms earn abnormal returns and Frazzini, Kabiller, and Pedersen (2018) showed that by including a betting-against-beta factor and a quality-minus-junk factor, Buffett's alpha becomes insignificant. These models could be intriguing to explore more in the Nordic countries.

11 CONCLUDING REMARKS

This thesis is one of the first studies that examined quality investing strategies and compared them to value investing strategies in the Finnish stock market. In addition, the objective was to test, whether it would be possible to combine value investing strategies with quality investing and yield superior results. Moreover, as far as the author of this thesis was aware, no previous studies regarding the quality aspects of stocks in the Finnish stock market had been conducted. Ratios relevant to the topic, such as gross profitability and Grantham's quality score, had not been widely studied either in the Finnish market.

The general belief in the market has been that value stocks have been underperforming growth stocks in the U.S after the financial crises. At the same time, quality investing has found more ground in the financial markets across the world. This study found contradicting results for the Finnish stock market regarding value investing compared to the U.S. literature, while quality investing, as an alternative strategy, seemed to produce extraordinary performance in the Finnish stock market. The results of this study show a clear outperformance of quality investing strategies, value investing strategies and combined quality and value investing strategies compared to overall market. This is against the efficient market hypothesis. Financial markets are not perfect and there is space for professional portfolio managers to reveal information.

The most prominent investment strategies were achieved when Grantham quality score and combined quality and value portfolios were used as the criterion to form portfolios. The finding is economically significant. Although the results of this study show a clear outperformance of quality investing strategies, value investing strategies and combined quality and value investing strategies compared to overall market, one may ask how correlated these portfolios are with each other and the market portfolio? Is there any value-, quality or combined quality and value measures that outperforms all the other measured year by year? Probably not and that is why an average of multiple measures is typically the best. In this case, the best performing strategies are created based on Grantham quality score which is consisting of three different financial variables and combinations of quality and value which are consisting from two to four different financial variables. Lastly, this thesis took also up the discussion around formulaic based investing and its drawbacks and further research is needed on the topic.

The results of this study also contribute to the extensive literature review on the pricing models. This thesis applied two different asset pricing models, namely Carhart's four-factor model and Fama-French five-factor model. Although Carhart's four-factor model have excessively studied in the Finnish stock market, the Fama-French five-factor model has received lesser attention. The author of this thesis wanted to explore which one of these pricing models would be a more suitable model. In this study, the Fama-French five-factor model was more suitable as it had slightly higher explanatory power and the regression alphas were more statistically significant.

As a final note, the findings presented in this paper call for further research on two main topics. First, further analysis of the performance of portfolios formed based on quality ratios and combined quality and value ratios in the Finnish stock market could be beneficial for investors, who are seeking to invest in the Finnish stock market. Further evidence of extraordinary performance of some quality indicators and combined quality and value indicators that can help predict long-term performance, would be beneficial for investors. Second, studies incorporating new asset pricing models into the Finnish stock market, could help practitioners understand why statistically significant alphas have been generated in the past. Including a new quality factor or betting-against beta factor into the factor, could potentially help explain the abnormal returns.

12 REFERENCES

An, C., Cheh, J. & Kim, I. (2017). Do Value Stocks Outperform Growth Stocks in the U.S. Stock Market? Journal of Applied Finance & Banking, 7 (2), 99-112.

Asness, C., Frazzini, A. & Pedersen L.H. (2018). Quality Minus Junk. Review of Accounting Studies, 24, 34-112.

Asness, C., Frazzini, A., Israel, R. & Moskowitz, T. (2015). Fact Fiction and Value Investing. Journal of Portfolio Management, 42 (1).

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.

Bodie, Z., Kane, A., Marcus, A. (2014). Investments. McGraw-Hill Education.

Brooks C. (2019). Introductory Econometrics for Finance. Cambridge University Press.

Becchetti, L. & Ciciretti, R. (2009). Corporate Social Responsibility and Stock Market Performance. Applied Financial Economics, 19 (16), 1283-1293.

Carhart, M. (1997). On Persistence in Mutual Fund Performance. The Journal of Finance, 52 (1), 57-82.

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

Chan, R. & Lui, B. (2011). Seeking a True Picture of a Company's Financial Strength: EV/EBIT Ratio: The Best of Both Worlds. Better Investing, 27-28.

Chen, L. & Zhang L. (2010). A Better Three-Factor Model That Explains More Anomalies. The Journal of Finance 65 (2), 563-595.

Cheong, C., Ng, A. & Shen, J. (2019). Quality Investing in Asian Stock Markets. Accounting and Finance, 1-32.

Chopra, N., Lakonishok, J. & Ritter, J. (1992). Measuring Abnormal Performance: Do Stocks Overreact? Journal of Financial Economics, 31 (2), 235-268.

Cuthbertson, K. & Nitzsche, D. (2004). Quantitative Financial Economics: Stocks, Bonds and Foreign Exchange, 2nd Edition. John Wiley & Sons, Ltd.

Damodaran, A. (2004). Investment Fables: Exposing the Myths of Can't Miss Investment Strategies. FT-Press, London.

Davydov, D., Tikkanen, J. & Äijö, J. (2016). Magic Formula vs Traditional Value Investment Strategies in the Finnish Stock Market. Nordic Journal of Business, 65 (3-4), 38-54.

De Bondt, F. & Thaler, R. (1995). Financial Decision-making in Markets and Firms: A Behavioral Perspective. Handbooks in Operations Research and Management Science, 9, 385-410.

Edmans, A. (2011). Does the Stock Market Fully Value Intangibles? Employee Satisfaction and Equity Prices. Journal of Financial Economics, 101 (3), 621-640.

Fama, E., Fisher L., Jensen, M. & Roll, R. (1969). The Adjustment of Stock Prices to New Information. International Economic Review, 10 (1), 1-21.

Fama, E. (1970). Efficient capital markets. A review of theory and empirical work. Journal of Finance, 25 (2), 383-417.

Fama, E. & French, K. (1992). The Cross-Section of Expected Stock Returns. The Journal of Finance, 47 (2), 427–465.

Fama, E. & French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds. Journal of Financial Economics, 33 (1), 3–56.

Fama, E. & French, K. (1995). Size and Book-to-Market Factors in Earnings and Returns. The Journal of Finance, 50 (1), 131-155.

Fama, E. & French, K. (1996). Multifactor Explanations of Asset Pricing Anomalies. The Journal of Finance, 51 (1), 55-84

Fama, E. & Macbeth, J. (1973): Risk, Return and Equilibrium: Empirical Tests. Journal of Political Economy, 81 (3), 607-636.

Fama, E. & French, K. (1998). Value versus Growth: The International Evidence. Journal of Finance, 53 (6), 1975–1999.

Fama, E. & French, K. (2006). Profitability, Investment and Average Returns. Journal of Financial Economics, 82 (3), 491-518.

Fama, E. & French, K. (2015). A Five-factor Asset Pricing model. Journal of Financial Economics, 116 (1), 1-22.

Fisher, L., Jensen, M.& Roll, R. (1968). The Adjustment of Stock Prices to New Information. International Economic Review, 10 (1), 1-21.

Frazzini, A., Kabiller, D. & Pedersen, L.H. (2018). Buffet's Alpha. Financial Analysts Journal, 74 (4), 35-55.

Gallagher, D., Gardner P., Schmidt C. & Walter T. (2014a). Portfolio Quality and Mutual Fund Performance. International Review of Finance, 14 (4), 481-521.

Gallagher, D., Gardner P., Schmidt C. & Walter T. (2014b). Quality Investing in An Australian Context. Australian Journal of Management, 39 (4), 615-643.

Garff, D. (2014). Multi-Style Global Equity Investing: A Statistical Study on Combining Fundamentals, Momentum, Risk and Valuation for Improved Performance. The Journal of Investment Consulting, 15 (1), 12-26.

Givoly, D. & Palmon, D. (1985). Insider Trading and Exploitation of Insider Information: Some Empirical Evidence. Journal of Business, 58 (1), 69-87.

Goetzmann, W., Ingersoll & M. Spiegel. Portfolio Performance Manipulation and Manipulation-proof Performance Measures. Review of Financial Studies, 20 (5), 1503-1546.

Graham, B. & Dodd, D. (1934). Security Analysis. McGraw-Hill Education.

Grantham, J. (2004). The Case for Quality – The Danger of Junk. GMO White Paper.

Greenblatt, J. (2006). The Little Book That Still Beats the Market. John Wiley & Sons, Inc.

Greenblatt, J. (2010). The Little Book That Still Beats the Market. John Wiley & Sons, Inc.

Hanson, D. & Dhanuka, R. (2015). The” Science” and “Art” of High-Quality Investing. Journal of Applied Corporate Finance, 14 (1), 141-160.

Grossman, S. & Stiglitz, J. (1980). On the Impossibility of Informationally Efficient Markets. The American Economic Review, 70. (3), 393-408.

Jaffe, J. (1974). Special Information and Insider Trading. Journal of Business, 47 (3), 410-428.

Jegadeesh, N. & Titman, S. (1993). Returns to Buying Winners and Selling Losers: Implication for Stock Market Efficiency. Journal of Finance, 48 (1), 65-91.

Jensen, M. (1968). The Performance of Mutual Funds in the period 1945-1964.The Journal of Finance, 23 (2), 389-416.

Kok, U., Ribando, J. & Sloan, R. (2017). Facts About Formulaic Value Investing. Financial Analysts Journal, 73 (2), 1-34.

La Porta, R. (1996). Expectations and the Cross-section of Stock Returns. The Journal of Finance, 51 (5), 1715-1578.

Lalwani, V. & Chakraborty, M. (2018). Quality Investing in The Indian Stock Market. Managerial Finance 44 (4), 127-141.

Lakonishok, J., Schleifer, A. & Visny, R. (1995). Contrarian Investment, Extrapolation and Risk. Journal of Finance, 49 (5), 1541-1578.

Larkin, P. (2009). Can Individual Investors Capture the Value Premium? Journal of Business & Economic Research, 7 (5), 25-34.

Leivo, T. & Pätäri, E. (2009). Performance of the Value Strategies in the Finnish Stock Markets. Journal of Money, Investment and Banking, 2 (8), 5-24.

Leivo, T. & Pätäri, E. (2015). A Closer Look at Value Premium: Literature Review and Synthesis. Journal of Economic Surveys, 31 (1), 79-168

Linnainmaa, J. and Roberts, M. (2018). The history of the cross-section of stock returns. Review of Financial Studies 31, 2606-2649.

Lintner, J. (1965). The Valuation of Risk Assets on the Selection of Risky Investments in Stock Portfolios and Capital Budgets. Review of Financial Studies, 1, 41-66.

Malkiel, B. (1973). A Random Walk Down Wall Street: Including a Life-cycle Guide to Personal investing. Norton & Company, Inc.

Malkiel, B. (2003). The Efficient Market Hypothesis and Its Critics. Journal of Economic Perspectives: American Economic Association, 17 (1), 59-82.

Markowitz, H. (1952). Portfolio Selection. The Journal of Finance, 7 (1), 77-91.

Modigliani, F. & Modigliani, L. (1997). Risk-Adjusted Performance. Journal of Portfolio Management, 23, (2), 45-54.

Mossin, J. (1966). Equilibrium in a Capital Asset Market. Econometrica, 34 (4), 768-783.

Newey, W. & K. West (1987). A Simple Semidefinite, Heteroscedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica 55 (3), 703–708.

Novy-Marx, R. (2013). The Other Side of Value: The Gross Profitability Premium. Journal of Financial Economics, 71 (1), 5-32.

Piotroski, J.D. (2000). Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers. Journal of Accounting Research, 38, 1–41.

Piotroski, J.D. & So, E.C (2012). Identifying Expectation Errors in Value/Glamour Strategies: a Fundamental Analysis Approach. The Review of Financial Studies, 25 (9), 2841-2875.

Scholes, M. (1969). A Test of Competitive Hypothesis: The Market for New and Secondary Offerings. Unpublished PH.D. thesis, Graduate School of Business, University of Chicago.

Schwert, G. (2003). Anomalies and Market Efficiency. In Handbook of the Economics of Finance, 1 (15), 939-974.

Sharpe, W. (1964): Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. The Journal of Finance, 19 (3), 425-442.

Sharpe, W. (1966). Mutual Fund Performance, The Journal of Business, 39 (1),119-138.

Shiller, R. (2000). Irrational Exuberance, Crown Business.

Sloan, R.G. (1996). Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings. Accounting Review, 71 (3), 289-315.

Sortino, F. & R. van der Meer (1991). Downside Risk. Journal of Portfolio Management 17 (4), 27–31.

Sortino, F. & L. Price (1994). Performance Measurement in a Downside Risk Framework. Journal of Investing 3 (3) , 59–64

Sortino, F. (1994). Performance Measurement in a Downside Risk Framework. Journal of Investing, 3 (3), 50-8.

Suzuki, M. (1998). PSR – an Efficient Stock-selection Tool? International Journal of Forecasting, (2), 245.254.

Treynor, J., (1965). How to Rate Management of Investment Funds, Harvard business.

Treynor, J, Priest W., Fisher L., & Higgins C. Using Portfolio Composition To Estimate Risk. Financial Analysts Journal, 93-100.

Yen, G. & Lee, C. (2008). Efficient Market Hypothesis (EMH). Past, Present and Future, Review of Pacific Basin Financial Markets and Policies, 11 (2), 305-329.

Zaremba, A. (2016). Quality Investing and The Cross-Section of Country Returns. Studies in Economics and Finance, 33 (2), 281-301.

ELECTRONIC REFERENCES

Carosa .C (2019): How You can Profit as Market Shifts from Growth to Value Stocks. Available at: https://www.forbes.com/sites/chriscarosa/2019/10/10/how-you-can-profit-as-market-shifts-from-growth-to-value-stocks/#2aace5e26cb7. Accessed 11.2.2020

Fama, E. & French, K. (2019). The Value Premium. Working Paper No. 20-01. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3525096 [Accessed: 18 02 2020]

Lev, B. & Srivastava, A. (2019). Explaining the Recent Failure of Value Investing. Working paper, New York University – Stern School of Business & Haskayne of Business, University of Calgary, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3442539 [Accessed: 17 02 2020]

Li, Y. (2019). Is Value Investing Dead? It Might Be and Here's What Killed it. Available at: https://www.cnbc.com/2019/06/21/is-value-investing-dead-it-might-be-and-heres-what-killed-it.html [Accessed: 18 02 2020]

McDonald, M. (2017). Why the Price to Dividend Per Share Ratio is Better Than the P/E ratio. Available at: https://www.dividend.com/dividend-education/why-price-to-dividend-per-share-ratio-better-than-pe-ratio. [Accessed: 07 06 2020]

Novy-Marx, R. (2014). Quality Investing. Working paper, University of Rochester, NY. Available at: http://rnm.simon.rochester.edu/research/QDoVI.pd [Accessed: 17 02 2020]

Thomson Financial (2007). Worldscope Database: Datatype Definitions Guide. Available at: https://www-app.uni-regensburg.de/Fakultaeten/WiWi/roeder/DownloadsGeneral/Datastream%20 Worldscope.pdf [Accessed: 21 02 2020]