TALLINN UNIVERSITY OF TECHNOLOGY

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VALUE VS. GROWTH: FUNDAMENTAL INDEXATION IN HELSINKI STOCK MARKET

Bachelor's thesis

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I hereby declare that I have compiled the thesis independently
and all works, important standpoints and data by other authors
have been properly referenced and the same paper
has not been previously presented for grading.
The document length is 10643 words from the introduction to the end of conclusion.

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ABSTRACT

Two of the most known investment strategies are value- and growth investing. Value investors seek for undervalued stocks while growth investors tend to invest on shares with high fundamental values. Previous studies show that value portfolios outperform growth strategies due to the value premia. In addition to value- and growth investing a new investment strategy has gained a lot of attention and has risen to be one the most popular investment strategies among investors during the 21st century. The new investment strategy is fundamental indexation where indices are constructed based on fundamental values instead of the market-capitalisation. Previous studies have proved that fundamentally weighted indices outperform capitalisation-weighting. Since the Coronavirus pandemic hit the global markets causing a market crash in March 2020 the results are divided into time before and during Coronavirus. The aim of this study is to examine whether fundamentally constructed indices based on value- investment strategies can outperform growth portfolios and the market average in Helsinki Stock Exchange. The obtained results show that the value portfolio constructed based on low Price-to-Book values was able to outperform all other constructed portfolios before and during Coronavirus.

Keywords: Fundamental indexation, value investing, growth investing, COVID-19

INTRODUCTION

In year 1970 Eugene Francis Fama introduced the Efficient market hypothesis (EMF). According to Fama financial markets are efficient, meaning that stock prices already reflect all information available. EMF suggests that it would be relatively difficult or even impossible for investors to find stocks that could outperform the market. However, there have been several studies and investment strategies that have proved against the EMF. Many of these strategies have used fundamental weighting instead of the traditional capitalisation weighted index. A variety of these strategies have benefited from different kind of anomalies in the markets.

The aim of this thesis is to research whether fundamentally constructed indices based on value-investment strategies can outperform growth strategies and the market average in Helsinki Stock Exchange. In total four value- and four growth portfolios were constructed, each containing 20 stocks. The value portfolios contained companies with low fundamental values and growth portfolios were constructed based on high fundamental values. The fundamentals used in this research were Price-to-book (P/B), Price-to-Earnings (P/E), Price-to-Cash flow (P/CF) and Dividend Yield. The fundamentals were chosen since they have been widely used on previous studies of value- and growth investment strategies.

Previous studies have shown that fundamental indexation is able to outperform the market-capitalization weighted indices. According to the Noisy Market Hypothesis (Siegel 2006) most securities in the markets are incorrectly valued. When investing to capitalization weighted indices the investor gives more value to overvalued shares and less value to undervalued securities which can potentially lead to greater losses or lost revenues. Earlier studies have also shown that value stocks are able to outperform growth stocks. In year 1992 Eugene Fama and Kenneth French published the study "The Cross-Section of Expected Stock Returns" where they identified a value premium which indicated that value stocks have higher returns than growth stocks.

When choosing the topic, the author wanted to write about value- and growth investing. However, since the required rebalancing period for value stocks can be relatively long and because the topic would have required investigations on individual companies the author decided to combine all the topics of her interest which were value- and growth investing and fundamental indexation. The author started writing the thesis prior to Coronavirus pandemic and since the pandemic changed the market conditions the supervisors encouraged her to include the aspect of a financial crises into the thesis. Because of all the previously mentioned aspects the thesis got its current form.

The COVID-19 outbreak offered an interesting environment to investigate portfolio performances in extreme conditions. During the Coronavirus crises, global markets experienced the most dramatical crash since the crash of Wall Street in 1929. Coronavirus is a globally spread lethal virus and the worst pandemic that has ever been witnessed in the modern society. Due to the pandemic, consumption has decreased dramatically, which has led to a global economic crisis. In this study portfolio performances were compared to time prior and during COVID-19 by comparing the profitability against the overall index (OMXHGI) in the Helsinki Stock Market.

Capital Asset Pricing Model and the Efficient Market Hypothesis were widely introduced in this research. The reason behind it was that they provide an understanding of the history and explains the evolution behind these currently popular strategies. The history of CAPM is also relevant since the steepness of the Security Market Line, also referred as Sharpe Ratio is one of the ratios that the author used to evaluate the obtained results. The EMF provides a hypothesis for this research indicating that there should not be possibilities on outperforming the market average. Also, the study conducted by Fama and French (1992) is used as a hypothesis to assume that value portfolios will outperform growth portfolios.

The thesis was conducted with fundamental quantitative analysis. The research period covered 11 years and three months from the end of 2009 to March 2021 (31.12.2009-31.03.2021). All data for calculations were fetched from the Thomson Reuters Eikon database. The sample size contained 139 stocks from where companies from the financial sector had been filtered out. No separation between company sizes were made. However, there have been studies (Fama, French 1992) that proves the Small-cap effect when researching value investment strategies. The decision for including all company sizes into this research was due to the market size in Finland. There are only around 140 listed companies in Nasdaq Helsinki and if size limitations would have been made the sample size would have been too small to determine reliable results.

The obtained results present the performances of value- and growth portfolios. The results are divided so that the first part introduces the differences in individual portfolio performances. In this chapter the performances during Coronavirus are also discussed. All results are presented so that they either illustrate the total research period or quarterly average. The performances of both investment strategies are also evaluated. To obtain results for value- and growth investment strategies two indices were constructed so that the portfolio performances of each strategy were combined. At last, the limitations of the study and the conclusion are presented to sum up the thesis.

1. LITERATURE REVIEW

1.1. Evolution of fundamental indexation

1.1.1. Efficient Market Hypothesis

Efficient Market Hypothesis (EMH) was first introduced by an American economist and financial teacher Eugene Francis Fama. In year 1970 he published an article "Efficient Capital Markets: A Review of Theory and Empirical Work" where the EMH was firstly introduced. In the article Fama states that securities markets are efficient, meaning that the market prices constantly reflect all information available. Fama states that since all prices are already adjusted in the result of all provided, possible information, it is impossible or rather difficult to invest in stocks that could yield more than the market. The only possibilities he leaves for "beating the market" are luck, or riskier assets. According to Fama (1970) markets are unpredictable and highly volatile in behaviour and the market prices only changes due to new, published information. Due to the market efficiency, it is rather impossible to predict the future even with fundamental factors or historical information.

Fama proves his theory with three different tests: weak form-, semi-strong- and strong test. In weak form test, the historical prices and their ability to effect stock prices are considered. The semi-strong form test discusses, and mainly focuses on news that are publicly available, this news can be for example stock splits or acquisitions. Finally, he discusses the strong form test, which examines whether some groups, such as investors have privileged access to information given. After examining all tests Fama concludes that with minor exceptions all the tests prove the market efficiency and confirms his model (Efficient Market Hypothesis) to be relevant. (Fama 1970)

Later Fama's research on Efficient Market Hypothesis has gained a lot of criticism and has lost its relevancy due to newer research and studies (Malkiel 2003). Malkiel (2003) criticises the EMH in his article "*The Efficient Market Hypothesis and Its Critics*" and makes a statement, that markets are predictable and raises a point that many investors and research do believe, that stock prices are

even somewhat predictable. In addition, the Efficient Market Hypothesis is unable to explain market anomalies and price bubbles for which denotes the study to be defective. (Malkiel 2003)

1.1.2. The random walk -hypothesis

The Random Walk -hypothesis has a strong link to the Efficient Market Hypothesis. Some earlier forms of the theory had been studied and published by several professors (Regnault 1863, Bachelier 1900, Kendall 1953, Cootner, 1964, Fama 1965). (Lim *at al.* 2012)

However, the awareness of the term "Random Walk -theory" became familiar for a bigger audience after it was introduced by Malkiel (1973) in his book *"Random walk down Wall Street: The time-tested strategy for successful investing".* (Malkiel 2015)

The Random walk -hypothesis assumes that changes in stock prices are completely random and future earnings cannot be predicted based on historical returns. (Fama 1965) According to Fama (1970) historical stock performances do not have any memory and because of that reason technical analysis based on historical data would be useless. (Fama 1970) Malkiel (2007) states that stock market movements on a short term cannot be predicted at all. In addition, according to his paper (Ibid.) by investing to an index that contains all shares from a stock exchange it is possible to receive better return, than by screening individual shares from the exchange. Malkiel states that during the last 30 years two-third of investors has lost to the market index. (Zhipeng)

1.1.3. Capital Asset Pricing Model (CAPM)

The idea behind Capital Asset Pricing -model and portfolio theory was introduced by Harry Markowitz in his essay "*Modern Portfolio Theory*" (1952). However, the model is said to be develop by Sharpe (1964), Lintner (1965), and Black (1972). The capital asset pricing -model was one of the first models to answer the question; how the risk of an assets reflects the expected return (Perold, 2004). In Harry Markowitz's model it is expected that investors are choosing mean-variance -efficient portfolios, since investors only care about variance and mean on their investment return. (Fama, French 2004)

In Capital Asset Pricing Model two additional assumptions to Markowitz's theory is added; complete agreement and the assumption, that there is borrowing and lending at a risk-free rate.

(Fama, French 2004) Capital asset pricing -model illustrates a linear relationship with risk and expected return. The model quantifies the measure of risk, a systematic risk, also called as beta (β), and turns it to measures of expected return. (FTSE Russell; The anatomy of Smart Beta) The model proves that in order to generate bigger return, there must be an increase in the market risk associated with the same investment. The Capital asset pricing model illustrates, that not all risks reflect returns and in addition, that risk can be diminished or eliminated, when decentralized in a portfolio. (Perold, 2004)

One of the central concepts in Capital Asset Pricing -model is the Security Market Line (SML). The SML illustrates the correlation between expected return of a stock to the market risk (Stock Beta). The steepness of the slope illustrates the risk premia, also known as the Sharpe Ratio (or Sharpe Index). Depending on the placement of the share in relation to the SML the correlation between risk on return can be evaluated. All shares in line with the SML can be considered as correctly balanced, since the return, when considering its risk, is fair. However, shares placed below the SML can be considered as relatively undervalued, since they offer a good return in relation to their risk and vice versa with shares above the SML. (Fama, French 2004)

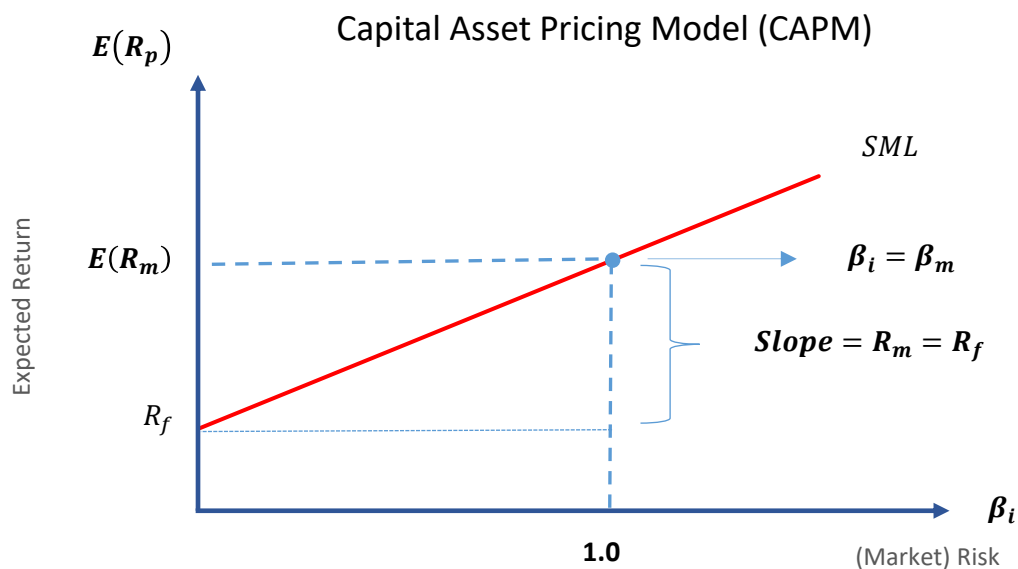Figure 1. Capital Asset Pricing Model; The Securities Market Line (Fama, French 2004)
Source: Prepared by the author

According to CAPM the risk is a sum of two different components, the unsystematic and systematic risk. The unsystematic risk is firm specific and can be diversified. The other component is the systematic risk, the market risk, which is non-diversifiable. The risk component in CAPM

has been investigated a lot in later research. The foundation for the later discovered value investing and fundamentally weighted investment strategies has its origin in the research made criticizing the Capital Asset Pricing model. It is also considered as the origin for capitalization-weighted indexing (Kaplan 2008) In addition, there have been several attempts to improve the model, for example in year 1993 Fama and French invented the Three Factor model, by adding two factors: size and value to the valuation of stocks. Later they (Fama, French 2015) extended the Three Factor Model in to Five Factor model. (Fama, French 2015)

The Capital Asset Pricing Model has been given a lot of criticism, since there have been several studies that have been capable on proving that other factors can have an impact on stock performance and can be the explanatory factors in increased stock value and/or return. One of the first studies, also a major step towards the fundamental indexation and Value Investing -strategies, was made by Eugene Fama and Kenneth French (1992). In their paper *"The Cross-Section of Expected Stock Returns"* (1992) they (Fama, French 1992) identified a value premium, indicating that value stocks have higher returns than growth stocks. They were able to prove that stocks with low book to market ratios had lower average returns than stocks with high book to market ratios. In addition of the value premium they also identified a capitalization bias. The capitalization bias proved, that over the long-term smaller companies by market capitalization were able to outperform larger companies, this is also known as the Small Cap effect. (Fama, French 1992)

1.3. Fundamental Indexation

In year 1970 Eugene Francis Fama introduced the Efficient Market Hypothesis (EMF). According to EMF stock prices reflect all information available and it would be rather impossible or exceedingly difficult for investors to find stocks that could outperform the market. However, many studies after Fama have succeeded on proving that markets and stock prices can be outperformed by using different methods. One of the newer strategies, also the one that has gained a lot of interest is fundamental indexation. Fundamental indexation was first introduced by the Nobel awarded William Sharpe when he in the early 1960' presented a hypothesis, that risk factors are mainly driving the profits of investments. (Arnott *et al* 2005) However, it did not gain its popularity then, but a lot later, when Arnott et al. (2005) published a research of fundamental investments. (DoubleLine 2021) After this research fundamental indexation started to wake interest among investors. One of the main reasons for such popularity is that fundamental indexation is rather easy

compared to the more "traditional" investing methods where company financials, balance sheets, historical data and future predictions among other things are taken into consideration. (Hsu, Campollo 2006)

Fundamental Indexation is a combination of active- and passive investing and it offers an alternative weighting strategy for the traditional market capitalisation. In fundamental indexation, indices are constructed based on different fundamental values so that each company is weighted according to its fundamental value. (Perold 2007) A central belief in fundamental indexation is that the company fundamentals give better estimations on the actual value of the company than the market capitalisation. The market capitalisation can be misvalued which could potentially harm the investor. (Hsu 2006) Fundamental strategies are often also called smart beta strategies. (Davidow 2014) In smart beta strategies investors have the benefit of passively following indices, but still active managing their portfolios. The active management is based on active index management and indices can have different weighting schemes based on investors preferences. The most common ones are either different fundamental factors or some other schemes such as value, liquidity or size. Several studies have shown that smart beta strategies are able to outperform the market despite the efficient market hypothesis. (Davidow 2014)

In capitalization-weighted strategies the weight of an asset in a portfolio is given based on its market capitalisation. The *Noisy Market Hypothesis* developed by Jeremy Siegel (2006) suggest that majority of stocks in the markets are incorrectly valued. According to Siegel (2006) the mis valuation of stocks in the markets are caused by investors and companies that have other reasons for selling and buying securities than the actual price. Siegel (2006) states that by using market-capitalisation strategies the investor gives more value to overvalued securities and less value to undervalued assets. For this reason, the market-capitalization weighted indices are not necessarily optimal for investors. Based on Siegel (2006) the *Noisy Market Hypothesis* explains the positive returns of fundamentally constructed indices and challenges the efficient market hypothesis. (Perold 2007)

The sub-optimality of cap-weighted indices have been widely studied. In a research made by Jason C. Hsu (2006) (2006, 1) it was concluded that market prices do not always reflect the actual value of the company and for that reason fundamental valuation should be preferred. It was concluded that in an index constructed by market-capitalization the undervalued companies had the lowest value, and the overvalued companies had the highest value which was not optimal for the investor.

The study also indicated that for this reason non-cap-weighted indices would be a better option for an investor since the weighting of the asset would be closer to the actual (fair) value. The study concludes that when markets are noisy and not reflecting the company fundamentals the non-cap-weighted indices outperforms cap-weighted indices. (Hsu 2006)

1.4. Value and Growth Investing

One of the most studied investment strategies is value investing. The fundamental idea behind value investing is to find companies (stocks) from the market, that are undervalued based on their fundamentals. Value companies have usually low fundamental values, and the shares are usually undervalued. In several studies, value investing has succeeded on proving, that it is possible to find undervalued stocks that later outperforms the market. Value stocks can be considered risky since the stock might be undervalued for legitimate reason meaning that the value of the stock will not rise in the future. (Lakonishok *et al.* 1994)

The opposite investment strategy for value investing is growth investing. Growth investors aim to seek stocks, that provides good earnings for the investments. These kinds of companies (stocks) are expected to keep outperforming the market average. Growth stocks have usually high fundamental values and can be interpreted as "expensive shares". It is typical for these kinds of companies to not pay dividends since all earnings are invested back into the company to generate profit and to secure a high growth rate. Growth stocks can be considered risky, since the share prices are already high and if the company is not able to maintain the above average growth rate the value of the stock can decrease dramatically. (Chan, Lakonishok 2004)

When identifying value- or growth stocks company fundamentals are investigated. The definition for a value stock is usually determined when a company is trading at a lower price than its fundamentals would require. In value investing the main goal is to find undervalued stocks, that have high returns in relation to their book assets, earnings, dividends or other fundamentals. Growth stock are vaguely defined as the opposite of value stocks, whit high fundamental values and stocks that tend to be overvalued. As an exemption the fundamental value for dividend yield is different. For value stocks a high dividend yield is characteristic, since value companies are usually stable companies, with consistent dividends. For growth companies, the dividend yield

often equals to zero ("0"), since the companies usually reinvest dividends back into the company to guarantee continuous growth. (Chan, Lakonishok 2004)

For value stocks the return is gained when the price of the stock stabilises and increases to the level of its intrinsic value. In growth investing the returns are often already high and the companies tend to be large and popular and for that reason they are expected to yield even greater returns in the future. Several studies of value- and growth investment strategies have focused on the following fundamentals: cash flow to price, price to earnings, dividend yield and price to book value and for that reason they are used in this study as well. (Lakonishok *et al.* 1994)

1.5. Behavioural Finance

Behavioural finance is a quit young study in the field of finance. However, it can be an interesting manner of an approach when it comes to studying anomalies in finance during a crisis. Behavioural finance is a study where cognitions and feelings of investors influences the way they think and behave. Behavioural finance is also a topic, that challenges the Efficient Market Hypothesis. According to EMF investors act rationally and always aim to maximize the profit. During the 1990's and after the financial crisis in year 2008 the incompetence of the current financial theories was noted. The current theories were not able to explain the changes in the markets and neither the correlations between the risk and return. (Mandelbrot 2008)

Behavioural finance offered alternative answers to unexpected changes and irrational behaviour. Behavioural finance has gained popularity during the last few decades; however, the first studies have been conducted already during the 1970'. According to behavioural finance, investors are prone to act irrationally and make mistakes. Their (investors) behaviour can be explained with psychological factors that drives investors in stock markets. The reason for misvalued stocks can also be explained by the incompleteness of people. (Shiller 2013) According to Malkiel (1973) "most chartists [1] believe that 90% of the market is psychological and only 10% is logical". (Malkiel 1973)

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[1] Chartist = "Technical analysis is the method of predicting the appropriate time to buy or sell a stock used by those believing in the castle-in-the-air view of stock pricing. Thus, its practitioners are called chartists." (Malkiel 1973)

1.6. COVID-19

Coronavirus pandemic, later (February 2020) named as COVID-19 pandemic by WHO (World Health Organisation) is a global pandemic caused by a SARS-CoV-2 -virus. The outbreak started at the end of year 2019 in Wuhan China. The origin of the outbreak is uncertain, but two-thirds of the early detected cases could be traced back to a seafood market in Wuhan and the virus is believed to be originated from a bat. The virus is spreading through air and can be caught when in close contact [2] of affected people. (He *at al.* 2020)

On January 30th of 2020 WHO named COVID-19 as a public health emergency due to the rapidly rising amount of infected people. On March 2020, COVID-19 was characterized as a global pandemic. (World Health Organisation 2020)

As of April 2021, there are over 160 million confirmed cases and 3.3 million deaths caused by the Coronavirus throughout the world. The pandemic is still ongoing (April 2021) with increasing number of confirmed infections and deaths. (Our World in Data 2021)

The COVID-19 outbreak has had severe effects to the world. Companies, governments and societies have been forced to adapt into situations which have never been seen before. Several countries have been forced to take strict measures, like total lockdowns which has led to a crisis in the global economy. The decreased amount of consumption and the unawareness on the future has resulted on a crisis like never seen before. According to IMF (International Monetary Fund), all 197 economies in the world have been forced to take additional actions to control and diminish the economic and human impact of the COVID-19 pandemic. (International Monetary Fund 2021).

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[2] Close Contact = "Someone who was within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to test specimen collection) until the time the patient is isolated." (Centers for Disease Control and Prevention)

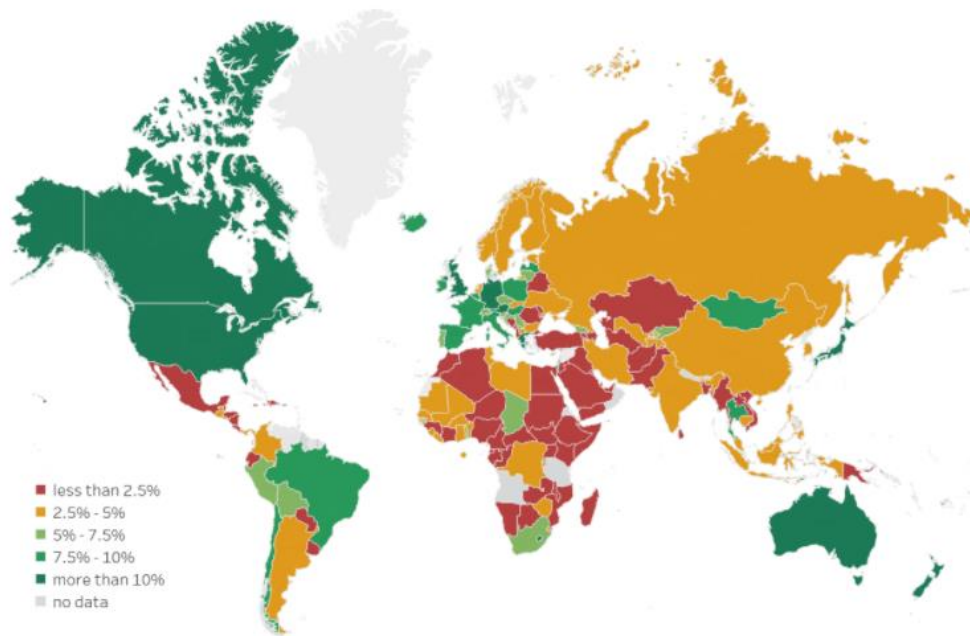Figure 2 below illustrates the additional spending and forgone revenue in response to the COVID-19 pandemic.

Figure 2. Additional Spending and Forgone Revenue in Response to the COVID-19 Pandemic (Percent of 2020 GDP)
Source: International Monetary Fund: Fiscal Policies Database (imf.org)

One of the major reasons for the uncertainty in the global markets was the lack of medicine and vaccine for the virus. The vaccine for coronavirus has been developed during year 2020 and the vaccination of people have started. The vaccine was developed four times faster than any other vaccine in the history. Also, the required spread and need for the vaccine is four times greater than for any other vaccine throughout the history of the world, which makes this the largest global health initiative the has ever taken place. (McKinsey & Company 2021)

First vaccines for coronavirus were given on December 2020 which started to give hope for the people around the globe. (McKinsey & Company 2021) Several countries have already managed to vaccinate large amounts of their population which has enabled restrictions to be diminished or even dissembled entirely. The world economy has now reached the recovery face and the IMF is

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projecting a 6.0% growth in the global economy for year 2021 and 4.4% growth for year 2022. (International Monetary Fund 2021)
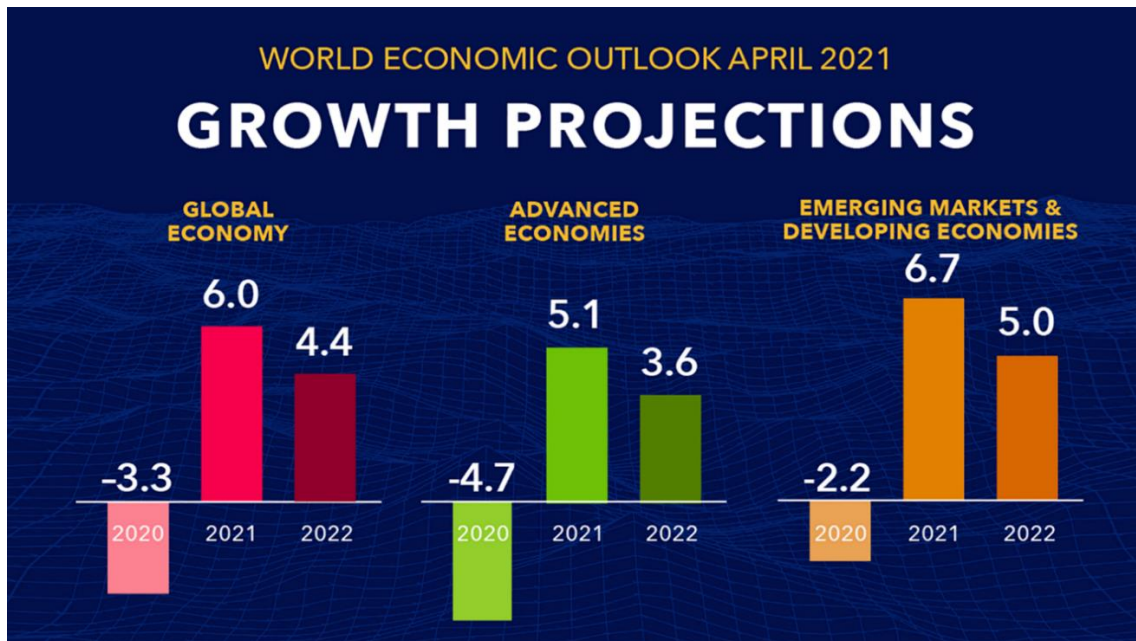

Figure 3. Growth Projections

Source: International Monetary Fund 2021: World Economic Outlook, April 2021: Managing Divergent Recoveries (imf.org)

2. DATA AND METHODOLOGY

2.1. Data collection

This research is conducted in the Finnish stock market, Nasdaq Helsinki. The sample contains stocks from all industries except the financial sector[3]. The overall sample size is 139, including companies that were listed in the exchange on 30.9.2020. The original sample for this study was gathered in September 2020 and for that reason the specific timepoint was selected. The sample contains two (2) companies that are no longer (April 2021) listed in the Helsinki exchange. The delisting of these two companies does not affect the research since they were not selected to the portfolios that were constructed (rebalanced) after 30.09.2020. These companies are Neo Industrial Oyj and Yleiselektroniikka Oyj which were both merged into other companies.

All data used to conduct results was collected from the Thomson Reuters DataStream (Eikon). The research period covered 11 years and three months from the end of 2009 to March 2021 (31.12.2009-31.3.2021). The portfolio rebalancing period is three months covering in total 46 quarters for the entire research period. Calculations were made from the Daily Time Series Ratios that were fetched as end of quarter values for the following days; 31.12.; 31.03.; 30.06.; 30.09. The ratios used in this study are price-to-cash flow (P/CF), Price-to-Earning (P/E), Price-to-Book value (P/B) and Dividend Yield. In addition, the quarterly values for market capitalisation for each company were fetched to enable calculations for portfolio weight.

All data for benchmark index OMXHGI was fetched from the webpage of Nasdaq and some data for illustrative charts were fetched from the websites of Yahoo Finance and Nasdaq Nordic.

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[3] "We exclude financial firms because the high leverage that is normal for these firms probably does not have the same meaning as for nonfinancial firms, where high leverage more likely indicates distress". (Fama, French 1992)

2.2. Benchmark Index

All portfolios were compared to the benchmark index "OMXHGI" which is a market-capitalisation weighted, all-share return index from Nasdaq Helsinki. The index is not weight capped and it illustrates the overall performance and change in the Finnish Market. The author did not construct a benchmark Index by herself but did a comparison of two of the most used indices in the Finnish Market. The indices that were compared together were OMXH25 and OMXHGI. The OMXH25 - index contains the 25 most traded companies in the Finnish market. It is a capitalization-weighted index with a 10% weight cap limitation. The Figure 4 below illustrates the performance of STOXX50E, OMXH25 and OMXHGI. The STOXX50E is an Index of stocks in the Eurozone. It is commonly used as a reference index when researching the overall performance in the Euro area. It is provided by the Deutsche Börse Group and weighted by the free-float market-capitalization. The STOXX50E has been added to Figure 4 as a comparative measure to enable comparison between the Finnish Market and the Eurozone which is relevant due to the ongoing Coronavirus outbreak.

Figure 4 illustrates the amount of Euros earned if 100 euros would have been invested to each index on 31.12.2009. The performance of the OMXHGI -index was the best (ending balance 292,8€) and for that reason it was selected as a benchmark in this study.
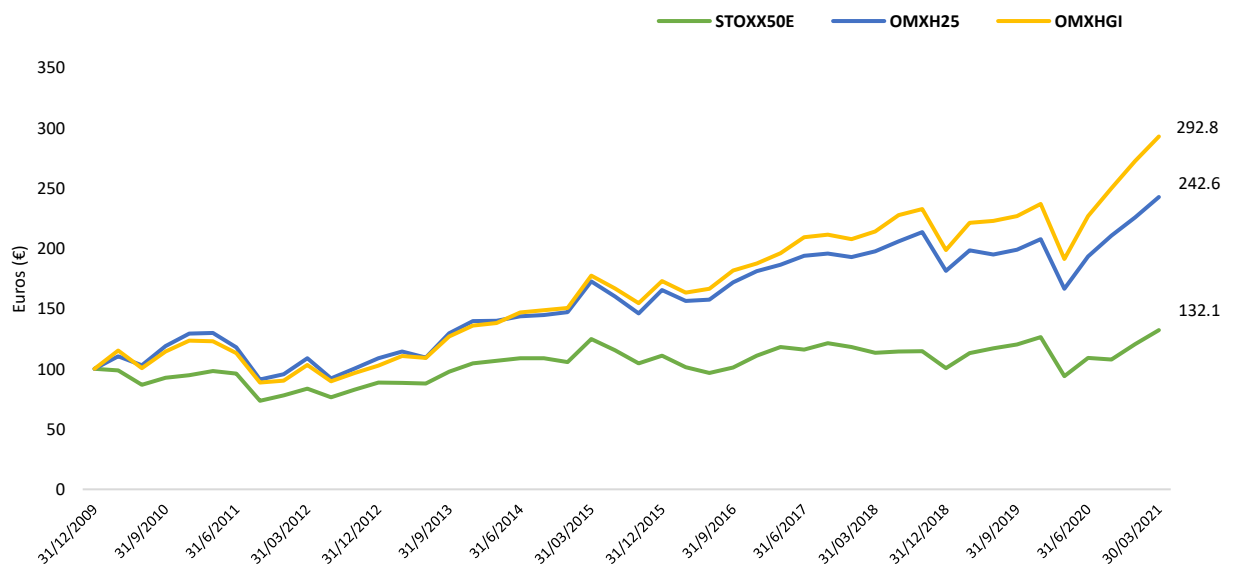

Figure 4. Performance of STOXX50E, OMXH25 and OMXHGI

Source: Compiled based on author's calculations

2.4. Portfolio Construction

In total eight portfolios were constructed from four different financial ratios. From each financial ratio two portfolios were constructed: one value portfolio and one growth portfolio. For value portfolios the greatest value was given to the company with the lowest fundamental and for growth portfolio the greatest value was given to the highest ratio. The only exception was with Dividend Yield portfolios where value companies were weighted so that the highest weight was given to the highest ratio and with growth portfolios so that the lowest value was given to the lowest ratio. In total eight portfolios were constructed all including 20 stocks, with different fundamental weighting. For Dividend Yield growth -portfolio, the author decided to exclude all companies where Dividend Yield equals to zero ("0"). The reason behind it was that the number of companies with zero dividend was not constant and for that reason the portfolio sizes would have been significantly different in each quarter and the portfolios would not have been comparable with each other. For Dividend Yield growth portfolio companies with the lowest Divided Yield (>0) were selected and the portfolio size for each quarter was 20. The same calculation technique was used in all portfolios and all calculations were conducted in excel.

Company Market Cap was fetched directly from Thomson Reuters DataStream (Eikon) to a separate excel sheet covering the entire research period. The market capitalizations were fetched for every quarter for the entire research period. The company market capitalization was needed to later calculate weighted value of a stock in a portfolio.

For all ratios quarterly values were fetched directly from Eikon to Excel. No clean-up for the data was made. The sample included all 139 companies and respective ratios were fetched for each company for the entire research period (31.12.2009-31.03.2021). Since the rebalancing period was three months, ratios were fetched for the end of every quarter for the entire research period. In total 46 values of each ratio were fetched for each company. For growth portfolios the companies were arranged from the largest ratio to smallest and for each quarter 20 companies with the largest ratios were picked to a separate excel sheet. The same was repeated for value portfolios, but the data was arranged from smallest value to the largest. After this was done the separate excel sheets for value and growth portfolios both contained 46 sets of ratios for each company and each set was arranged based on the ratio size.

Value and growth portfolios were calculated with the same method, except for value portfolios a reverse ratio was calculated whereas for growth portfolios no reverse ratio was needed.

Identical calculations were made for each portfolio for each quarter to get the portfolio quarterly returns. For value portfolios the reverse ratios were calculated first. The reverse ratio was calculated by dividing the ratio with 1. All reverse ratios were then calculated together to get the total. For growth portfolios ratios were directly summed up. To get Stock Weights for each portfolio the ratios were divided by the calculated total sums of ratios. Then the Market caps for current and following quarter were fetched from a separate excel sheet by using an Index and Match function with multiple criteria. The current stock value was calculated by multiplying the current market cap with the stock weight. After the current stock value was calculated the change in the market cap was calculated with the relative change formula.

(1)

$$\frac{\Delta \gamma}{\gamma(a)} = \frac{\gamma(b) - \gamma(a)}{\gamma(a)}$$

where

$\Delta \gamma$ – Change in Market Capitalisation

$\gamma(a)$ – Previous Market Capitalisation

$\gamma(b)$ – New Market Capitalisation

The stock value was then multiplied by 100% and after, the ending stock value was calculated by multiplying the current stock value with the change in the market cap. The portfolio quarterly return was received by dividing the ending stock value with the current stock value and subtracting the answer by "1".

When all quarterly returns had been calculated they were put in a line in the correct time order from 31.12.2009 to 31.03.2021. After the line had been formed, they were all summed with number "1" to get the adjusted return. The first adjusted return was multiplied with 100 to illustrate the number of actual returns received after 3 months if 100 euros had been invested on 31.12.2009. The following quarterly return was then multiplied by the previous actual return received and so on. Finally, when the last value of the time period had been calculated the total portfolio return was then calculated with the relative change formula (Figure 1.) where $\gamma(b)$ is the return from 30.03.2021 and $\gamma(a)$ is the number "100" representing the initial investment to the portfolio.

2.4. Market Conditions

2.4.1. Stock Market Crash 2020

The coronavirus hit the global markets hard. During the end of February and the beginning of April 2020 the stock markets crashed due to the instability that COVID-19 had caused. The crash was the fastest ever witnessed in the current financial history and it was the worst since the Great Depression in 1929. (Statistics Finland 2020)

During 21st to 28th of February 2020 several indices reported dramatic losses. The Dow Jones Industrial Average- index reported worst daily decline ever recorded (3000 points in March 2020) and declined total 6400 points during February. The S&P 500 experienced a 34% decline in value.

Figures 5, 6 and 7 below represents the dramatical losses in the US and Eurozone on Black Thursday (12 March 2020). The markets were later stabilized after the Federal Reserve and several other banks and governments announced measures to heel and support the economies.
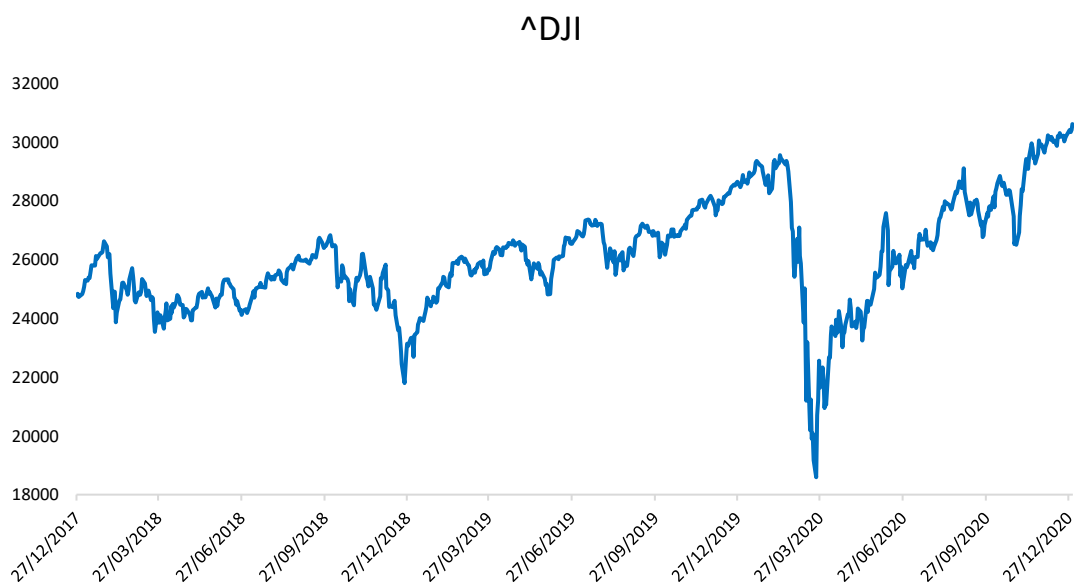
Figure 5. Dow Jones Industrial Average (^DJI)

Source: Yahoo Finance https://finance.yahoo.com/ 30 December 2020, Prepared by the author
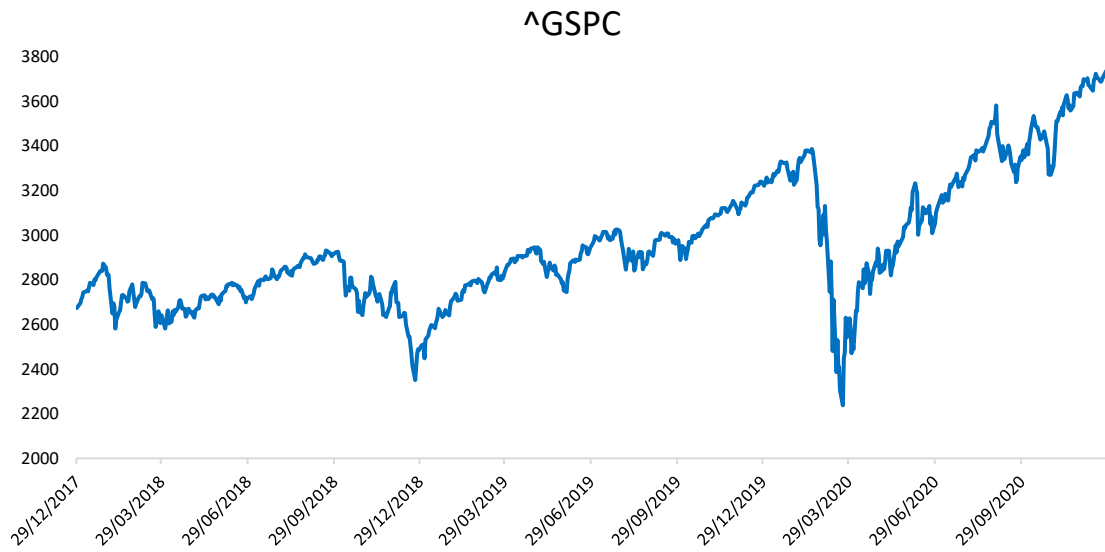
^GSPC

Figure 6. S&P 500 (^GSPC)

Source: Yahoo Finance: https://finance.yahoo.com/ 30 December 2020, Prepared by the author
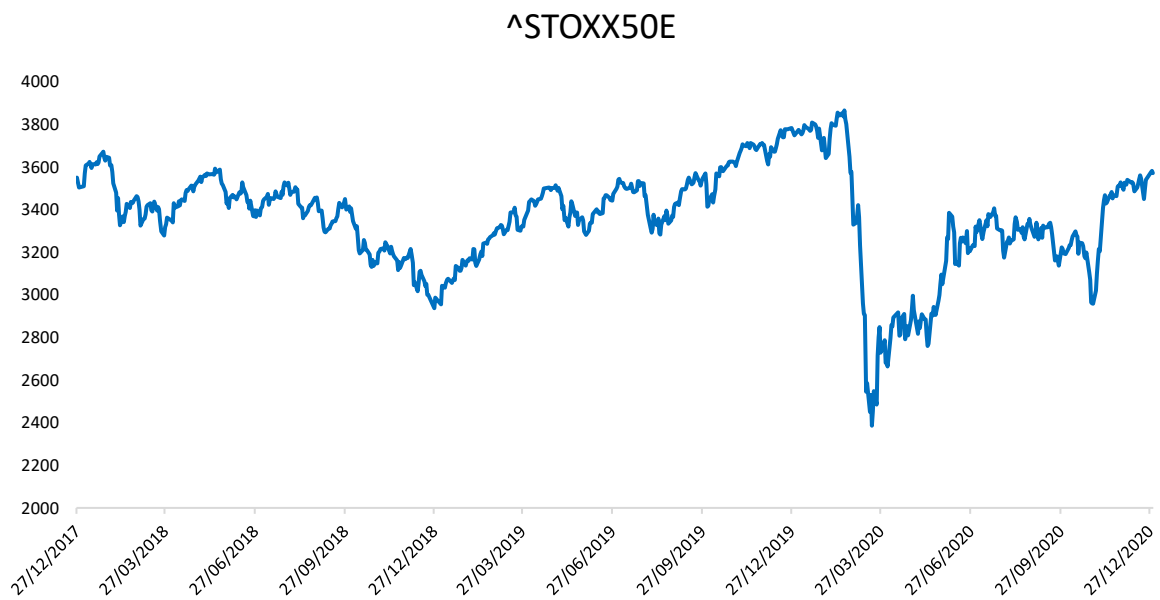
^STOXX50E

Figure 7. ESTX 50 PR.EUR (^STOXX50E)

Source: Yahoo Finance: https://finance.yahoo.com/ , 30 December 2020, Prepared by the author

2.4.2. COVID-19 impacts in Finland

According to Eurostat (2020) (13th of November 2020) the economy in Finland has survived better than several other countries in the EU. The GDP decline for Finland in the second quarter of 2020 was 6.4% (YoY) when the respective figure for EU was 14%. The total decline in GDP in year 2020 was 2.8%. (Tilastokeskus 2021)

Comparing to other Nordic countries the number of bankrupt companies due to coronavirus were the highest (April 2020). If comparing to year 2019 the rate of bankruptcies increased by 26%. (Enento 2020) The compensations of employees given to households grew in the third quarter and it affected positively to consumption. (Tilastokeskus 2021)
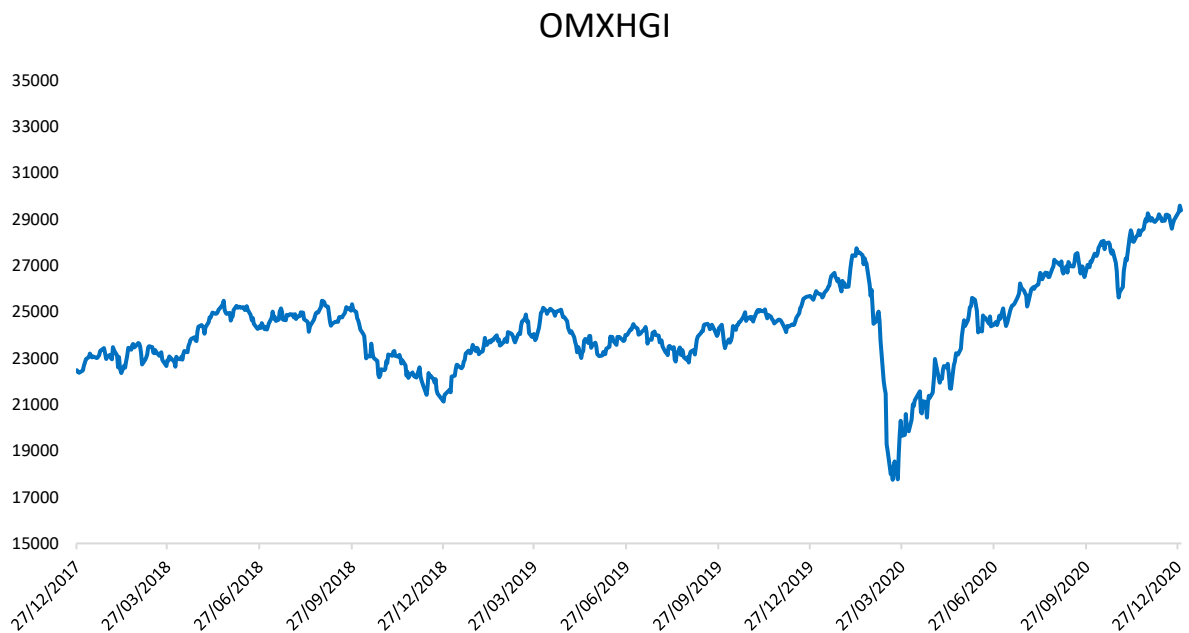
Figure 8. Performance of the Finnish stock market
Source: Nasdaq Nordic: http://www.nasdaqomxnordic.com/ , 30 December 2020, Prepared by the author

The year 2020 ended slightly above a 10% increase in the Helsinki Stock market. The overall index was close to 11 000 points, which is the highest since January 2008 right before the last market crash. The markets in Finland are optimistic (April 2021) since a quarter of the whole population

(5.5 million) have already been vaccinated and COVID-19 related restrictions are being dissembled. (Yle 2021).

3. RESULTS

All results are presented in quarterly metrics since the research period for Coronavirus is relatively short and cannot be presented in yearly metrics. Transaction cost and management fees were not taken into consideration in any of the calculations.

3.1. Overall performance of constructed portfolios

In total eight portfolios were constructed. From all constructed portfolios only three were able to outperform the Reference Index that had the total return of 192.8%. The best performing portfolio was PB Value Stock with the return of 1162.9%.

For all portfolios calculation of a hypothetically invested 100€ was made. The Table 1 below illustrates the ending value of each portfolio if 100€ would have been invested on 31.12.2009. The Table 1 also illustrates the total returns and total excess returns for each portfolio. The total excess returns were calculated by subtracting the total return of the benchmark from the total return of the constructed portfolio.

Table 1. Performance of each portfolio during the research period of 31.12.2009-31.3.2021

	Ending value of 100€ in 31.3.2021	Total Return (%)	Total Excess Return (%)
Reference	292.8€	192.8%	-
Dividend Yield Value Stocks	189.9€	89.9%	-103.0%
Dividend Yield Growth Stocks	344.8€	244.8%	+51.9%
PE Value Stocks	265.2€	165.2%	-27.6%
PE Growth Stocks	271.4€	171.4%	-21.4%
PB Value Stocks	1262.9€	1162.9%	+970.1%
PB Growth Stocks	183.9€	83.9%	-108.9%
P/CF Value Stocks	280.4€	180.4%	-12.5%
P/CF Growth Stocks	647.1€	547.1%	+354.2%

On average the ending value for the 100€ investment was 430.7€ which is 137.9€ higher than for the benchmark. The PB Value Stocks -portfolio had the highest ending value of 1262.9€, being the best investment strategy out of all portfolios. The worst performing portfolio was PB Growth Stocks with the ending value of 183.9€. The excess returns for the best and the worst performing portfolios were +970.1% and -108.9% respectively.

The Figure 9 below illustrates the overall performance of all portfolios and the benchmark for the entire research period. The benchmark is marked with a scattered line for illustrative purposes. The starting point in the chart is 100bps.
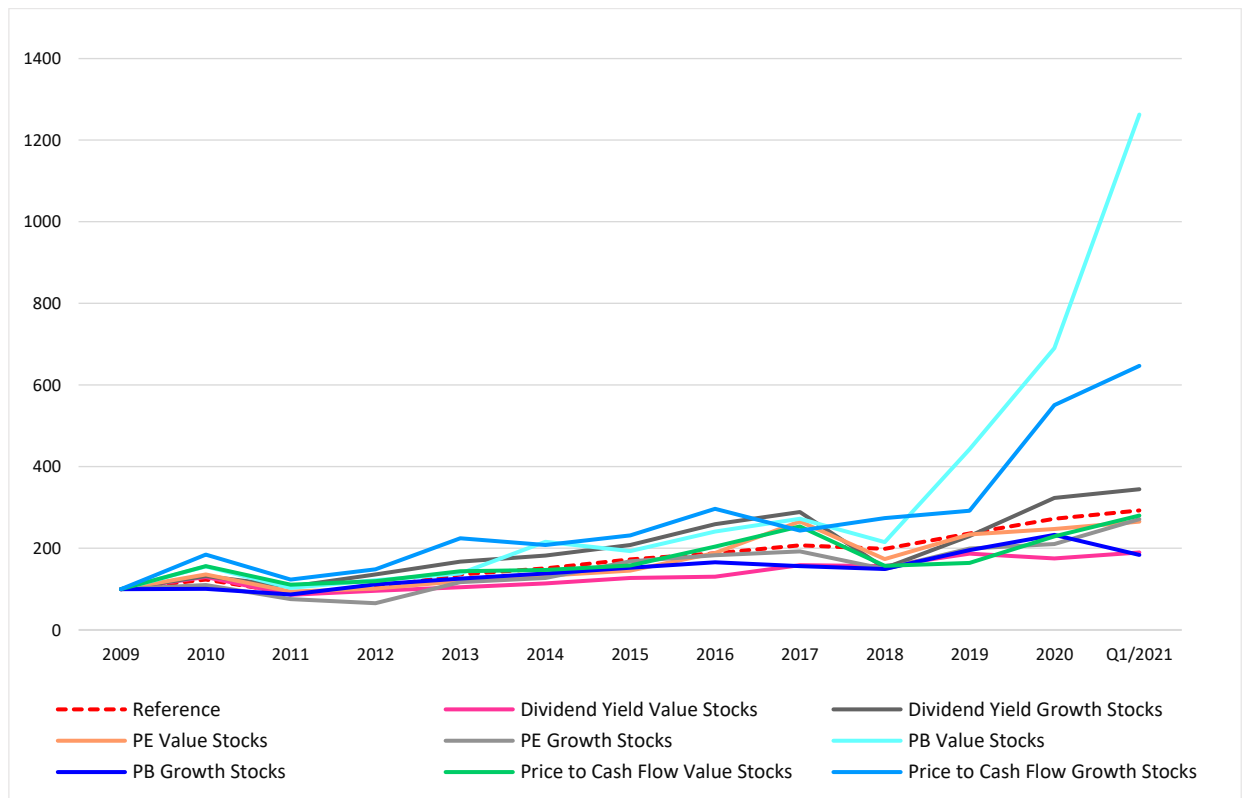

Figure 9. Total performance of each portfolio during the research period of 31.12.2009-31.3.2021
Source: Compiled based on authors´ calculations

Table 2. Quarterly measures for each portfolio during the research period of 31.12.2009-31.3.2021

	Average Return (%)	Average Excess Return (%)	Volatility (%)	Sharpe Ratio	Tracking Error (%)
Reference	2.9%	-	9.3%	0.305	-
Dividend Yield Value Stocks	1.9%	-0.92%	9.8%	0.198	6.0%
Dividend Yield Growth Stocks	3.6%	0.78%	13.0%	0.279	8.8%
PE Value Stocks	2.9%	0.01%	11.5%	0.250	7.0%
PE Growth Stocks	3.5%	0.67%	16.5%	0.214	10.1%
PB Value Stocks	7.6%	4.73%	20.2%	0.376	16.0%
PB Growth Stocks	1.8%	-1.04%	9.4%	0.194	7.5%
P/CF Value Stocks	3.3%	0.46%	14.6%	0.228	8.9%
P/CF Growth Stocks	5.2%	2.38%	14.9%	0.351	10.2%

The reference index had the quarterly return of 2.9% while the respective average figure for all the portfolios was 3.7%. The constructed portfolios exceeded the average quarterly return of the reference index by 0.8%. If looking at portfolios separately, there were three portfolios which were not able to outperform the average return of the reference index. These portfolios were Dividend Yield Value stocks, PE Value Stocks and PB Growth Stocks portfolio with the returns of 1,9%; 2,9% and 1.8% respectively. The best performing portfolio on a quarterly average was PB Value Stocks with the average return of 7.6%.

The average quarterly excess return for all portfolios was 0.9%. The PB Value stocks, which was the best performing portfolio had the excess return of 4.73%. PB Growth stocks had the poorest performance with a negative excess return of -1.04%.

The tracking errors for each portfolio were calculated to illustrate the difference in returns between each constructed portfolio and the reference index. The higher the tracking error, the greater the difference in return is. The tracking error for each portfolio was relatively high; over 6%, indicating that none of the portfolios were following the returns of the reference index closely. From the presented tracking errors, it can also be concluded that based on the performance of the reference index, the performance of these portfolios cannot be inferred. The average tracking error for all portfolios was 9.3%.

To measure the risk associated with each portfolio Volatilities and Sharpe Ratios were calculated. Portfolio volatility illustrates the swings in the price of an asset. Usually, portfolios with high

volatilities are riskier since the price is more difficult to predict. The volatility of each portfolio is the standard deviation of quarterly returns. The benchmark volatility is 9.3% which represents the overall volatility in the Helsinki Stock Market. PB Value Stocks had the highest volatility of 20.2% and based on that measure alone it could be considered as the worst investment in this research. PB Growth Stocks -portfolio had the lowest volatility, being 9.4% which is 0.01% higher than for the benchmark. The average volatility for all portfolios was 13.7%, being 4.4% higher than the respective figure for the benchmark.

Sharpe Ratio is a risk measure that represent the return associated with the amount of risk the portfolio holds. A higher Sharpe Ratio indicates a higher return for the risk that the investment holds. The Sharpe Ratio was calculated by dividing the average return with the volatility of the portfolio. The Sharpe Ratio for the benchmark was 0.305, which was one of the highest Sharpe Ratios for the entire research period. However, two portfolios; PB Value Stocks and P/CF Growth Stocks were able to outperform the benchmark with higher Sharpe ratios, being 0.376 and 0.351, respectively. PE Growth Stocks had the lowest Sharpe Ratio of 0.194.

Based on the obtained results PB Growth Stocks can be considered as one of the worst performing portfolios in this study. The portfolio did not generate any excess returns (-1.01%), had the lowest Sharpe Ratio (0.194) and the Volatility was relatively high compared to the generated returns. The best performing portfolio was PB Value Stocks, with the highest Sharpe Ratio (0.376) and the best average quarterly return 7.6%, which is 4.7% better than the respective figure for the benchmark.

3.2. Portfolio performances during COVID-19

The COVID-19 outbreak has significantly affected the global markets. The outbreak started at the end of 2019 and the economic impacts begun from the end of December 2019. The markets crashed in March 2020 and it was the fastest crash that had ever been witnessed and the worst crash since the Wall Street crashed in 1929. Table 3 (below) presents the ending values of 100€ investments for the timeperiod of 31.12.2019-31.03.2021. The table also illustrates the amount of euros that the investor would have gained or lost during the time of this period, which is the time when the COVID-19 outbreak has affected the global markets. The author wants to clarify that the Coronavirus pandemic is still ongoing, but the research period in this study ends to 31.03.2021 and for that reason the presented figures end in March 2021.

Table 3. Ending values and returns of a 100€ investment made on 31.12.2019

	Ending Value of 100€ on 31.3.2021	Return of a 100€ investment 31.12.2019-31.3.2021
Reference	123.7€	+23.7€
Dividend Yield Value Stocks	101.7€	+1.7€
Dividend Yield Growth Stocks	150.0€	+50.0€
PE Value Stocks	113.5€	+13.5€
PE Growth Stocks	136.0€	+36.0€
PB Value Stocks	285.1€	+185.1€
PB Growth Stocks	93.9€	-6.1€
P/CF Value Stocks	171.1€	+71.1€
P/CF Growth Stocks	221.7€	+121.7€

The ending value for the reference index was 123.7 euros, which was relatively low compared to the other portfolios. Only three portfolios were not able to outperform the reference index and generated lower returns. The best investment would have been PB Value Stocks, where the investor would have earned 185,1€ by investing 100€ on 31.12.2019. The worst investment was PB Growth Stocks, where the investor would have lost 6.1 euros with the ending value of 93.9€. The average return for all portfolios was 59.1€ which is 35.4€ higher that the respective return for the benchmark. From Table 3 it can be concluded that despite the short time period and the market crash, all returns have been relatively good. The markets are currently optimistic and experiencing a recovery period. Several countries have been able to vaccinate people and to dissemble COVID-19 related restrictions which has affected the consumption positively. These could be seen as possible reasons on why majority of the portfolios have experienced high growths on a relatively short time period. However, during a recovery period right after the market crash it is a common phenomenon the market bounces back, causing a steep incline in the markets.

Figure 10 below illustrates the performance of the portfolios during COVID-19. The starting point in the chart is 100bps and the reference index has been marked with a scattered line for illustrative purposes.
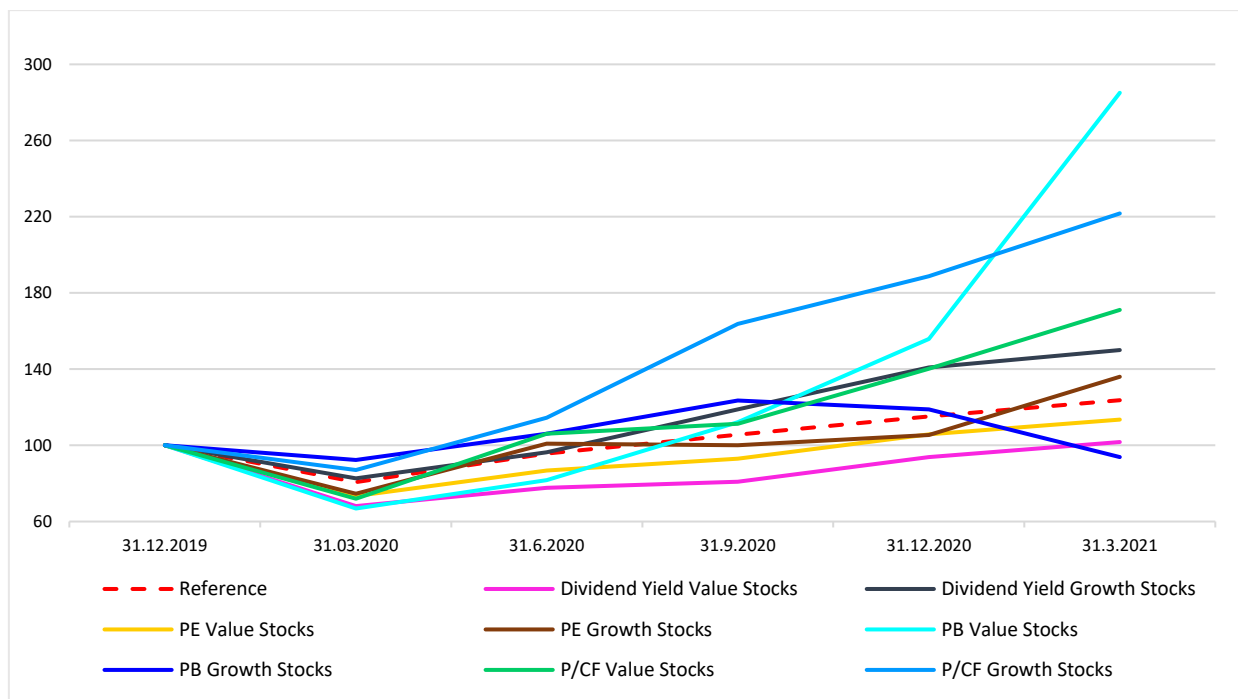
Figure 10. Total performance of each portfolio during COVID-19 (31.12.2019-31.3.2021)

Source: Compiled based on authors´ calculations

The average excess return for all portfolios was 35.4% which is relatively high. For three portfolios the total excess returns where negative. The worst performing portfolio was PB Growth Stocks with the total excess return of -29.8%. The best performing portfolio was PB Value Stocks with the total excess return of 161.4%.

Table 4. Total Return and Total Excess Return during COVID-19 (31.12.2019-31.3.2021)

	Total Return % (31.12.2019-31.3.2021)	Total Excess Return % (31.12.2019-31.3.2021)
Reference	23.7%	-
Dividend Yield Value Stocks	1.7%	-22.0%
Dividend Yield Growth Stocks	50.0%	26.3%
PE Value Stocks	13.5%	-10.2%
PE Growth Stocks	36.0%	12.3%
PB Value Stocks	185.1%	161.4%
PB Growth Stocks	-6.1%	-29.8%
P/CF Value Stocks	71.1%	47.4%
P/CF Growth Stocks	121.7%	98.0%

Table 5 below presents the Average Quarterly Returns, Volatilities, Sharpe Ratios and Tracking errors for each portfolio during Coronavirus. The same calculation method was used as in the quarterly metrics presented in Table 2. on the previous chapter 3.1.

Table 5. Average Quarterly Returns, Volatilities, Sharpe Ratios and Tracking Errors during COVID-19 (31.12.2019-31.3.2021)

	Average Quarterly Return (%)	Volatility (%)	Sharpe Ratio	Tracking Error (%)
Reference	5.2%	14.4%	0.363	-
Dividend Yield Value Stocks	2.1%	19.6%	0.109	7.4%
Dividend Yield Growth Stocks	9.5%	16.2%	0.587	6.6%
PE Value Stocks	4.0%	17.7%	0.224	4.5%
PE Growth Stocks	8.7%	24.4%	0.356	14.6%
PB Value Stocks	29.6%	41.8%	0.710	33.7%
PB Growth Stocks	-0.2%	15.9%	-0.014	15.9%
P/CF Value Stocks	14.5%	28.2%	0.513	15.9%
P/CF Growth Stocks	18.9%	21.1%	0.896	11.1%

Source: Compiled based on author's calculations

The best performing portfolio during Coronavirus was PB Value stocks with the quarterly return of 29.6%. The return for PB Value Stocks was 24.4% higher than the respective figure for the benchmark (5.2%). The worst performing portfolio was PB Growth with the return of -0.2%, being also the only portfolio with a negative quarterly return during Coronavirus. The average quarterly return for all portfolios was 10.9%.

The volatilities of all portfolios were higher than the benchmarks' which was 14.4%. The PB Value Stocks portfolio had the highest volatility of 41.8%. Based on the Volatility only the PB Value Stocks -portfolio could be considered as the worst investment since it had the highest volatility indicating the highest risk. From all portfolios PB Growth Stock had the lowest Volatility (15.9%) and for that reason it could be considered as the least risky and the "best" investment, even if the overall performance was the worst. The average Volatility for all the portfolios was 23.1%, being 8.7% higher than the respective value for the reference index.

The obtained results for Sharpe Ratio can be considered as relatively interesting since the Sharpe Ratio for the benchmark index is lower than the average Sharpe Ratio for all the portfolios. The Sharpe Ratio for the reference index was 0.363 while the respective average figure for all portfolios was 0.423. A higher Sharpe Ratio indicates a better return for the risk that the investment holds and for that reason it can be concluded that on average the constructed portfolios would have been a better investment than the benchmark. The P/CF Growth Stocks -portfolio had the highest Sharpe Ratio being 0.896 and PB Growth Stocks has the lowest Sharpe Ratio, being a negative value of -0.014. A negative Sharpe ratio can indicate that the performance of the portfolio is below the risk-free-rate.

Even if PB Value Stocks had the highest average returns, the P/CF Growth Stocks -portfolio can be considered as the best investment. The Average Quarterly return for P/CF Growth Stocks was 18.9%, which is 8.0% higher than the portfolio average and 13.7% higher than for the benchmark. In addition, the Volatility of the portfolio is 21.1% being 2.0% lower than the average (23.1%). Also, this investment had the highest Sharpe Ratio, meaning that it will offer the best return compared to the risk it holds.

The performances of all indices were combined to compare the overall returns to the reference index during Coronavirus. All quarterly average returns are presented in Table 6 below. Based on the quarterly average figures it can be noted that on average fundamental indices outperformed the benchmark on all other quarters except the first one. The second quarter (31.03.2020 -31.6.2020) was the best for both, where the reference index had the return of 18.6% and all the portfolios yielded 25.0%. The biggest difference in returns were during the last quarter (30.12.2020-30.03.2021) when the difference in returns was 11.7%. It can be concluded that during a crisis and a recovery period fundamental indexation is able to outperform the market average.

Table 6. Average Quarterly Returns of all portfolios and the reference index during Coronavirus (31.12.2019-31.3.2021)

	Average Return 31.12.2019 - 31.03.2020	Average Return 31.03.2020 - 31.6.2020	Average Return 31.6.2020 - 31.9.2020	Average Return 31.9.2020 - 30.12.2020	Average Return 30.12.2020 - 30.3.2021
Reference	-19.3%	18.6%	10.3%	9.1%	7.4%
All portfolios	-22.9%	25.0%	16.9%	16.3%	19.1%

Source: Compiled based on author's calculations

3.3. Comparison of Value- and Growth investment strategies

To compare value and growth investment strategies the measures for all value- and growth portfolios where combined to construct an overall index for each strategy. The overall average returns for the entire research period for value- and growth investment strategies are illustrated in Figure 11. It can be noted that value portfolios performed better and experienced a more rapid growth right after the previous financial crisis at the end of 2009. The same phenomena can be seen at the end of this research period, where value strategies are outperforming growth strategies. However, if looking at the long bull market (after the last financial crises and before the COVID-19 market crash), the growth strategies have performed better on average.
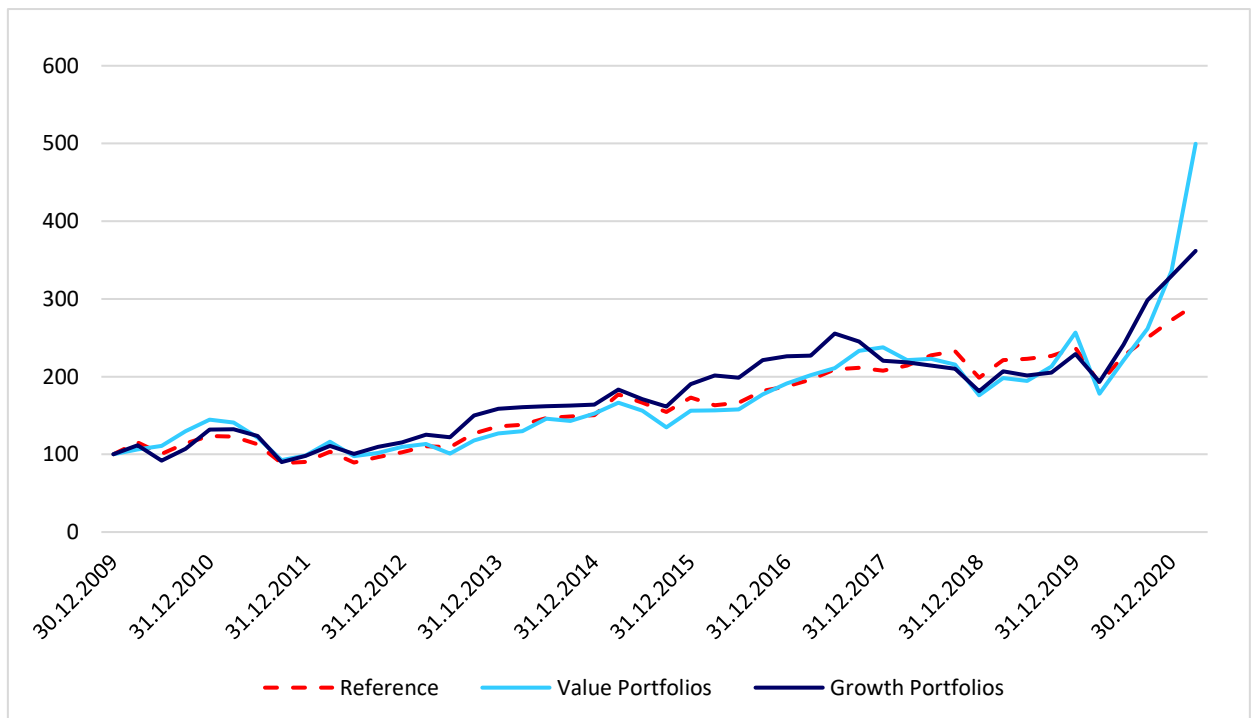

Figure 11. Average performances of Value- and Growth investment stragies
Source: Compiled based on authors´ calculations

To compare the performances average total returns and average excess returns were calculated for both strategies.

Table 7. Average Total Returns and total Excess Returns for Value- and Growth investment strategies on 31.12.2009-31.03.2021

	Average Total Return	Average Total Excess Return
Reference	192.8%	-
Value Portfolios	399.6%	206.8%
Growth Portfolios	261.8%	69.0%

Source: Compiled based on author's calculations

Based on the obtained results both strategies were able to outperform the benchmarks' total return of 192.8%. The value strategies outperformed growth strategies by having a 137.8% higher average total return. The excess return for value strategies was also significantly higher than for growth strategies being 206.8% and 69.0% respectively. To conclude the investor would have yielded 137.8% better during the entire research period by investing in value strategies.

The quarterly measures were also presented to compare the results obtained for the time of Coronavirus.

Table 8. Average Quarterly measures for Value- and Growth investment strategies (31.12.2019-31.3.2021)

	Average Quarterly Return	Average Quarterly Excess Return	Average Quarterly Volatility	Average Quarterly Sharpe Ratio	Average Quarterly Tracking Error
Reference	2.9%	-	9.3%	0.305	-
Value Portfolios	3.9%	1.1%	14.0%	0.263	9.5%
Growth Portfolios	3.6%	0.7%	13.4%	0.260	9.1%

Source: Compiled based on author's calculations

For both strategies, the average Sharpe Ratios were relatively low compared to the benchmark. The value strategies had a higher Sharpe Ratio than the growth strategies indicating that it would be a better strategy for the investor. The Tracking errors for both strategies were relatively high being 9.5% for value strategies and 9.1% for growth strategies. The volatilities for both strategies were higher than for the benchmark which indicates that neither of the strategies could be considered as a safer investment compared to the benchmark.

3.3.1. Value- and Growth investment strategies during COVID-19

The obtained results were calculated from December 2019 to the end of March in 2021 (31.12.2009-31.03.2021). The Figure 14. below illustrates the overall performance of both strategies and the reference index during Coronavirus.
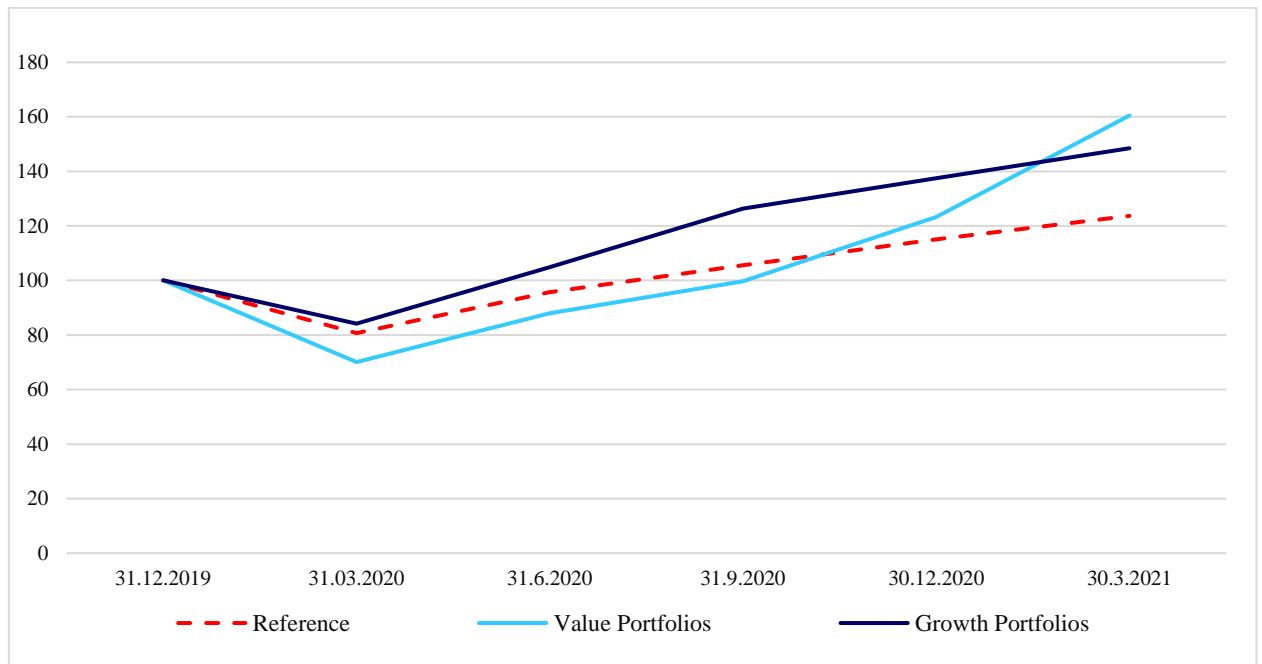

Figure 12. Overall performance of value- and growth strategies during COVID-19 (31.12.2009-31.03.2021).

Source: Compiled based on authors calculations

From the Figure 12 above it can be noted, that during the entire time of the pandemic, growth strategies have been able to outperform value strategies, until the recent few months. It is also worth mentioning the value strategies took a deeper dive during the market crash and did not outperform the reference index until late 2019.

The Table 9 (below) presents the total returns, average quarterly returns, total excess return and tracking errors for both strategies. Value strategies were able to outperform growth strategies also during the time of Coronavirus. If comparing the total excess returns, the value strategies had 17.5% higher excess return than growth strategies, which indicates that during crisis value indecis are able to outperform growth strategies.

As an quarterly average, the value portfolios yielded 3.4% more than the growth portfolios and 7.4% more than the benchmark. The tracking errors for both strategies were relatively high being 15.4% for value strategies and 12.1% for growth strategies.

Table 9. Ending value of 100€ investment, total return, total excess return, average quarterly reutnr and the tracking error for Value- and Growth portfolios (31.12.2019- 31.03.2021)

	Total Return %	Total Excess Return %	Average Quarterly Return	Tracking Error
Reference	23.7%	-	5.2%	-
Value Portfolios	67.8%	44.2%	12.6%	15.4%
Growth Portfolios	50.4%	26.7%	9.2%	12.1%

Source: Compiled based on author's calculations

The volatility for the reference index during the time period from 31.12.2019 to 31.03.2021 was 14.4%. The respective figure for value portfolios was 26.8% and for growth portfolios 19.4%. The volatility of the value portfolios, which had the best performance was relatively higher than for growth portfolios. Based on the volatility it can be concluded that value strategies during pandemic are considered riskier that growth strategies. The growth strategies were also able to outperform the benchmark by 26.7% but had lower volatility than value portfolios and for that reason could be seen as a safer and perhaps a "better" investment strategy for an investor during a crisis.

Table 10. Volatility and Sharpe Ratio for Value- and Growth Portfolios (31.12.2019-31.03.2021)

	Volatility	Sharpe Ratio
Reference	14.4%	0.363
Value Portfolios	26.8%	0.389
Growth Portfolios	19.4%	0.456

Source: Compiled based on author's calculations

If looking at the Sharpe Ratios; Growth portfolios had the highest Sharpe Ratio, being 0.456, when the same ratio for value portfolios was 0.389 and for the benchmark 0.363. Based on the Sharpe ratio only, growth strategies generated more revenue, compared to the risk it holds during a crisis and for that reason it could be seen as the better strategy out of value- and growth strategies. It should also be noted that the Sharpe Ratio for the Reference index was the lowest. Based on this

it can be concluded that it is better to invest to fundamental strategies than to an overall market index during a crisis.

3.4. Analysing obtained results

To conclude the obtained results, all measures are presented in tables divided in to three different time periods:

1. Time before Coronavirus
2. Time during Coronavirus
3. Entire research period covering both the time before- and during Coronavirus

The overall returns for these three time periods are presented in Table 11 below. The cells are colour coded so that green colour indicates the best performance and red colour indicates the worst performance during a specific time period.

Table 11. Total returns before- and during coronavirus and for the entire research period.

	Total Return before Coronavirus	Total Return during Coronavirus	Total return for the entire research period
Reference	136.8%	23.7%	192.8%
Dividend Yield Value Stocks	86.7%	1.7%	89.9%
Dividend Yield Growth Stocks	129.8%	50.0%	244.8%
PE Value Stocks	133.7%	13.5%	165.2%
PE Growth Stocks	99.6%	36.0%	171.4%
PB Value Stocks	**343.0%**	**185.1%**	**1162.9%**
PB Growth Stocks	95.8%	**-6.1%**	**83.9%**
P/CF Value Stocks	**63.9%**	71.1%	180.4%
P/CF Growth Stocks	191.8%	121.7%	547.1%

Source: Compiled based on author's calculations

Based on the obtained results it can be concluded that out of all portfolios PB Value Stocks had the best performance during all time periods and would have been the best investment strategy for an investor. The worst performing portfolio before Coronavirus was P/CF Value stocks with the overall return of 63.9%, which is relatively lower than for the benchmark. However, the worst performing portfolio during Coronavirus and for the total research period was PB Growth stocks.

Table 12. Total return before- and during Coronavirus and for the entire research period for Value and Growth Portfolios.

	Total Return before Coronavirus	Total Return during Coronavirus	Total return for the research period
Reference	136.8%	23.7%	192.8%
Value Portfolios	**156.8%**	**67.8%**	**399.6%**
Growth Portfolios	129.3%	50.4%	261.8%

Source: Compiled based on author's calculations

For all time periods value strategies were able to outperform the reference index, which is the overall market average in the Helsinki Stock Exchange. The Growth strategies were also able to outperform the benchmark but had significantly lower returns than value strategies in each time period. Based on the presented findings it can be concluded that fundamental indexation outperforms the market average and value strategies do outperform growth strategies.

All presented results in this study have concluded that value portfolios outperform growth portfolios. However, the results can be considered as distorted, since the PB Value Stock portfolio alone had significantly high returns which distorts all calculations where portfolio performances are combined. If looking at Table 13 below it can be noted that during all time periods only value portfolios constructed based on low Price-to-Book values were able to outperform all other portfolios. The other value portfolios constructed based on other fundamentals have not been able to outperform growth portfolios.

Table 13. Total returns for Value- and Growth portfolios before- and during Coronavirus and for the total research period

	PB Strategies		PE Strategies		Dividend Yield Strategies		P/CF Strategies	
	Value	Growth	Value	Growth	Value	Growth	Value	Growth
Total Return before Coronavirus	343.0%	95.8%	133.7%	99.6%	86.7%	129.8%	63.9%	191.8%
Total Return during Coronavirus	185.1%	-6.1%	13.5%	36.0%	1.7%	50.0%	71.1%	121.7%
Total return for whole research period	1162.9%	83.9%	165.2%	171.4%	89.9%	244.8%	180.4%	547.1%

Source: Compiled based on author's calculations

The results in Table 13 indicate that growth portfolios constructed based on Dividend Yield and Price-to-cash flow had better returns during all time periods compared to value portfolios. Also, for Price-to-Earnings, the returns were better for growth portfolios during Coronavirus and for the entire research period.

3.5. Statistical Significance of the Study

To measure the statistical significance of the results a t-test was performed for each portfolio. T-test measures the differences between the means of two groups and whether the differences can be considered significant or not. The hypothesis that should be rejected is the 0 hypothesis, assuming that the means of both samples are equal to "0". The t-test was conducted for quarterly excess return by using Data Analysis -tool in excel and conducting the Two-Sample Assuming Unequal Variances -test. The alpha level of 0.05 was used, meaning that if the p-value exceeds the level of alpha the results cannot be considered significant, but are only received by change. All t-statistics and p-values are presented in Table 14.

If looking at the compiled results it can be noted that only one portfolio had the p-value below the required alpha level of 0.05. PB Value Stocks had the p-value of 0.03 and for that reason the compiled results can be considered as significant. This portfolio was also the best performing out of all portfolios in this research.

Table 14. T-statistics of quarterly excess return and p-value during COVID-19 (31.12.2019-31.3.2021)

	t-statistics of excess return	p-value
Dividend Yield Value Stocks	-1.03	0.15
Dividend Yield Growth Stocks	0.60	0.28
PE Value Stocks	0.01	0.49
PE Growth Stocks	0.45	0.33
PB Value Stocks	1.98	0.03
PB Growth Stocks	-0.92	0.18
P/CF Value Stocks	0.35	0.36
P/CF Growth Stocks	1.57	0.06

Source: Compiled based on author's calculations

3.6. Limitations of the Study

There are five notable limitations in this study which could decrease the reliability of this study. The first limitation is that this research does not provide any comparative metrics from any other financial crisis. For that reason, the obtained results from the time of Coronavirus cannot be considered as significant since no comparison of the results can be made. The second limitation is that the research period during COVID-19 is relatively short which does not give a proper outlook on the portfolio performances during a crisis. The third limitation is that the T-test only proved one of the portfolios to be statistically significant. This indicates that the other obtained results cannot be considered as significant and would require more investigation. The fourth limitation is that the rebalancing period for the portfolios is only three months. Value investment strategies should require a longer rebalancing period since it can take several years for the stock to yield above average market returns. (Lakonishok, Vishny 1994) The fifth limitation is that the study did not consider any transactions costs nor management fees. These fees are usually higher for fundamentally weighted indices than for capitalisation-weighted portfolios. This can distort the results for the portfolio total returns and can possibly change the conclusion in this research.

CONCLUSION

Several studies have shown that fundamental indexation outperforms the market-capitalization. In fundamental indexation companies are chosen based on fundamental values instead of the market capitalisation. The reason behind the popularity is that it is rather easy for an investor, it generates better returns compared to capitalization-weighting and it estimates the stock value relatively well. However, the capitalisation-weighting method is still widely used. Many of the large and well-known indices like S&P 500, Nasdaq Composite and Wilshire 5000 are capitalization weighted. Siegel (2006) criticized the capitalisation weighting method by concluding that it adds too much weight on overvalued shares and too little value for undervalued shares. The conclusion was that fundamental indexation would be optimal for an investor since the valuation of the stocks would be closer to its actual (fair) value.

The aim of this study was to examine whether fundamentally constructed indices based on value-investment strategies can outperform growth portfolios and the market average in Helsinki Stock Exchange. The results were divided into time prior and during the financial crises caused by the Coronavirus. The fundamentals used in this study were Price-to-book (P/B), Price-to-Earnings (P/E), Price-to-Cash flow (P/CF) and Dividend Yield. From each fundamental two portfolios were constructed. One with the highest ratios to form a growth portfolio and one with lowest fundamentals to form a value portfolio. The portfolios were weighted so that for value portfolios the highest value was given to the lowest ratio and for growth portfolios the highest value was given for the highest ratio.

The results show that fundamental indexation was able to outperform the benchmark before and during Coronavirus. The best performing individual portfolio was PB Value Stocks with the total return of 1162.9%. The Sharpe Ratio for PB Value Stocks was the highest and outperformed all indices including the benchmark. However, the portfolio was the riskiest, holding the highest average quarterly volatility of 20.2%. The worst performing portfolio was PB Growth stocks with

the lowest quarterly excess return and Sharpe Ratio. However, it is worth mentioning that PB Growth stocks had the highest Sharpe Ratio during the time of Coronavirus.

The comparison between value- and growth strategies showed that value strategies were able to outperform growth strategies during all examined time periods. However, the calculations for value strategies combined can be interpret as distorted due to significantly high returns from the PB Value Stocks -portfolio alone. The research show that Growth portfolios constructed by Dividend Yield and Price-to Cash flow had better returns before and during the financial crises than Value portfolios.

It was concluded that fundamental indexation outperformed capitalization-weighted strategies in the Helsinki Stock Exchange during the research period of 31.12.2009-31.3.2021. This supports the obtained results from previous studies. Even though the best performing portfolio was a value portfolio this study was not able prove whether value portfolios outperform growth portfolios on average.

The limitations of this study were discussed in chapter 3.6. One of the limitations were that the research period did not include any other financial crises and that the research period of the Coronavirus was relatively short. A suggestion for the future research would be to have a longer time period, including other financial crises in the research. This way the portfolio performances could be properly examined during bull and bear markets. The research also ignored the possible costs that might occur in portfolio investing. The future research should make calculations on the impacts of transaction costs and management fees to be able to obtain more realistic results for investors. A suggestion for future research would also be to include several rebalancing periods to examine the effects of different time periods on portfolio performances. At last, it is worth mentioning that neither this nor any other research based on historical figures can provide a guarantee for future returns.

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