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Financial Economics

Is ESG Investing The Future?

A Comparison Of Old And New Investment Strategies

Bachelor thesis 15 hp
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Abstract

This thesis researches whether investing in stocks with high ESG-scores is a viable investment strategy compared to investing in stocks with low PE-ratios. This has been done through first testing the relationship between annual returns and ESG-scores and PE-ratios respectively. After this, portfolios based on low and high ESG-scores and PE-ratios respectively, have been formed to compare the excess returns and the risk adjusted returns between the portfolios. The data used in these tests consist of 1957 firms that have been publicly traded on any US exchange for at least one year between 2010 and 2022. The results show that positive relationships with annual returns exist for both ESG-scores and PE-ratios. Further, although no differences in excess returns could be found between the portfolios, the high ESG portfolio is shown to be less risky in comparison thus providing higher risk adjusted returns.

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1. Introduction

In this chapter a background is laid out with the aim of introducing the general topic of the thesis. The problem description then connects the background with the thesis, providing a problematization that leads to why the thesis work is relevant. Further, the research question is presented in this section. At the end of the chapter the purpose of the thesis is established.

1.1. Background

The Efficient market hypothesis (EMH) developed by Fama in 1970 states that investors should not be able to systematically beat the stock market as all available information on an asset is already incorporated into its price.[1] Despite this, investors have always tried to find ways of making profit. With regards to the stock market, the search for possible methods of predicting future stock returns to beat the market has therefore always been a goal for investors.

In an attempt to disprove the EMH, Basu conducted a study in 1977 where portfolios based on price-earnings ratios (PE-ratios) were used. The results showed that portfolios containing low PE stocks performed better than high PE portfolios, while also beating the market.[2] This in turn led to countless more studies being made, showing similar results.[3] Thus, creating the belief by some that a market anomaly known as the low PE effect existed. Today, the PE-ratio is one of the most commonly used valuation metrics by investors.[4] Despite this popularity, whether or not predicting stock returns using PE-ratios is possible is still up for debate as conflicting results have been found.[5] Because of this, the search for new and possibly better investment strategies is still ongoing.

One investment strategy that has seen increasing usage throughout the 21st century among investors is environmental, social and governance investing, also called ESG investing. This type of investment strategy revolves around examining firms based on the three pillars

[1] Eugene F Fama, "Efficient capital markets: A review of theory and empirical work", The Journal of Finance 25:2 (1970). pp. 383-417.
[2] S Basu, "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 (1977), pp. 663-682.
[3] Basu was not the first to research the relationship between PE-ratios and returns but is one of the most cited works in this area, therefore being considered to have had a large influence on future studies.
[4] Bill Jiang, Investment Strategies A Practical Approach to Enhancing Investor Returns. (Springer International Publishing, 2022),
[5] In chapter 3, previous research on the PE effect is reviewed, discussing some of the studies that have questioned this effect.

environment, social, and governance to decide if the investment is good or not. At first this type of investing focused on ethical aspects as a means for the conscious investor to choose which investment best fit in with the investors values. However, this has later evolved into also taking into consideration potential economic benefits as it has been argued that it can increase risk adjusted returns.[6]

Looking at the evolution of ESG investing, the US SIF showed in their trend report from 2020 that it has grown rapidly, from accounting for just under $4 trillion in assets in 2012 to $16,6 trillion in 2020.[7] Seeing as society as a whole has focused more on sustainability during the 21st century this growth is not surprising. The United Nations (UN) mentioned in their report from 2004 that ESG related issues would become a focal point for investment decisions as these factors would contribute to more stable markets.[8] Later in 2015, the 17 sustainable development goals known as SDG were also introduced by the UN, further showing the importance of sustainable practices.[9] Looking at the public, the increase in natural disasters and the rise in beliefs of social justice combined with an increasing concern for their communities has played a big role on the public perception of ESG investing.[10] It is therefore easy to understand why ESG investing is at an all time high, but despite this, it is believed to continue to grow in the future. Forecasts show that the expected growth for ESG investing is triple that of traditional investments, and that half of all investments by 2025 will incorporate ESG.[11]

1.2. Problem Description

As investors want to be able to beat the market consistently, investment strategies that can contradict the statements of the efficient market hypothesis by Fama are always being searched for. Two investment strategies that have been developed during different times are the strategy of investing in low PE stocks and that of investing in high ESG scores. Investing in low PE stocks was popularized by Basu in 1977 while the recent increase in sustainable thinking among not only the public, but also among international organizations such as the UN, has made ESG

[6] Max M Schanzenbach & Robert H Sitkoff, "ESG Investing: Theory, Evidence, and Fiduciary Principles", Journal of Financial Planning (2020). pp. 42-50.
[7] US SIF Foundation, Report on US sustainable and impact investing trends 2020 (US SIF Foundation, 2020), pp. 1-7.
[8] The Global Compact, Who Cares Wins 2000 (The Global Compact, 2000), pp. 1-40
[9] United Nations, Department of Economic and Social Affairs, Sustainable Development, The 17 Goals, n.d., https://sdgs.un.org/goals [Retrieved 2023-05-11].
[10] Ryann Marotta, "The time for ESG investing is now", Journal of Financial Planning 34:6 (2021), pp. 64-67.
[11] Marotta 2021, pp. 64-67.

investing relevant during this past decade. The general consensus regarding both these investment strategies seem to be positive when examining previous research, even though some studies have shown contradicting results.[12] However, relevant research comparing the two strategies do not exist or have been difficult to find at the time of this thesis. Further, when examining the research for each respective strategy, there are large differences regarding the time of when the majority of research has been done. Most of the accessible, peer reviewed, and relevant research on PE-ratios in relation to stock returns has been done before 2010 with a great deal of it being before the year 2000. Newer studies can be found but most are focused on specific small markets or sectors. When it comes to studies examining ESG-scores relation to stock returns, most studies are instead from 2010 and forward since the concept is relatively new and since data on modern ESG-scores has not been available until recently. Looking at MSCI, one of the leading providers of ESG scores, they have only been rating companies based on ESG risk since 1999.[13]

With consideration of this, and since timeframe, data availability, and the markets examined vary throughout existing research, it is therefore difficult to assess which investment strategy provides the best returns for the investor. It is also possible that none of the investment strategies provide a way of systematically beating the market when considering the statements of the EMH. As an investor, a problem therefore arises when deciding what strategies to use. Is the older but perhaps more established strategy of investing in low PE stocks viable today? Is ESG investing the new way to go considering the change in societal preferences?

This thesis aims to provide an answer to these questions by thoroughly examining the relationship between returns and PE-ratios and ESG-scores. This will be done by using recent data on companies based in the United States, thus providing a recency aspect on the low PE effect which is not found in many similar studies. Regarding ESG investing, recency in the data gathered is important since this strategy has seen such rapid growth during the last years. Also, not limiting the data to one specific sector but rather all US based companies provides a large dataset. Further, to strengthen our results, three different tests will be conducted.[14] With respect to the problem description above, the research question developed for this thesis is therefore the following:

[12] A review of previous studies is found in chapter 3
[13] MSCI, ESG Investing, n.d., https://www.msci.com/our-solutions/esg-investing [Retrieved 2023-05-10].
[14] See chapter 4, Methodology

Is investing in high ESG stocks a valid investment strategy compared to investing in low PE stocks?

1.3. Purpose

The purpose of the thesis is to provide a comparison between two investment strategies, PE investing and ESG investing. Through this comparison contribution is not only put forward with regard to each separate investment strategy, but the comparison between the two adds to the literature as similar studies have not been found. Further, the results will also be interpreted with regards to the efficient market hypothesis.[15] As the methodology is largely borrowed from previous studies, although with some modifications, this thesis does not reinvent the wheel with regards to which methods are used. However, the hope is that this will provide increased believability for the results, in turn giving insightful conclusions regarding both strategies.

[15] The initial purpose of this thesis is not to test the efficient market hypothesis. However the results will be interpreted in relation to this as the EMH is a central theory when discussing the possibility of some investment strategies being able to systematically beat the market.

2. Theoretical framework

In this chapter, relevant theories, models and concepts are presented. These are crucial to the understanding of the methodology as well as the analysis of the results.

2.1. Efficient market hypothesis:

The efficient market hypothesis (EMH) is a theory, originally created by Fama and Samuelsson, that suggests that all currently available information about assets in the financial market is reflected in the market prices of these assets. Examples of information that are reflected are the assets risk, liquidity and market interest rates. Because of this, the theory states that investors should not be able to predict what future stock prices will be. Instead, according to Fama and Samuelsson, markets are informationally efficient which leads to future stock prices being unpredictable. This is because of the fact that if all information available is already incorporated in an asset's price, then the only thing that can change the price of the asset is if new information arises. This new information can however not be predicted since if it could be predicted, it would then already be included in the already existing information.[16]

Further, EMH states three different versions of itself. The first version being the weak version of EMH which has a strong linkage to the above explained random walk hypothesis. This version states that asset prices can't be predicted based on the assets past values since the past values do not incorporate any information about what the future values of the assets will be. The second version is the semi-strong version of EMH which states that relevant information that is publicly available will be included when investors evaluate asset prices. Therefore, it is impossible to systematically achieve profits based on public information trading. The third and last version is the strong version of EMH which states that asset prices incorporate both public and private information and therefore it is not possible to systematically profit based on private information. According to the strong version, investors that trade on private information can only profit from this information for a short period of time before other investors catch on and the advantage dissapears.[17]

[16] Eugene F Fama, "Efficient capital markets: A review of theory and empirical work", The Journal of Finance 25:2 (1970). pp. 383-417.
[17] Cihan Bilginsoy, A History of Financial Crises. (Abingdon, Oxon ; New York : Routledge, 2015),

2.2. PE-ratios

Price Earnings Ratio is a financial ratio which measures the price paid for a company's earnings. Basu concludes that current earnings are of great importance for the outlook of pricing stocks in the market. As a general rule, high ratios are associated with quality or rapidly expanding companies that investors value highly.[18]

$$PE = \frac{Price\ per\ share}{Earnings\ per\ share} \quad (1)$$

Price Earnings ratios have been popular for a long time with Basu being one of the first to present an investigation of the effect of the financial ratio 1977. PE and its effect on firm valuation has been popular and investigated several times since which is presented in this study.

Low PE-effect - Several sources report an effect, for example Basu, Kelly and Lakonishok which showed that companies with low ratios performed better than companies with high ratios.[19] These have all demonstrated this predictability among stocks based on constructed portfolios. However, a study that questions this is the previously mentioned study by Banz & Breen who show that the low PE effect is created by ex post-selection and look-ahead bias. This is based on a positive earnings surprise for companies with low PE ratios and a negative earnings surprise for companies with high PE ratios.[20]

2.3. ESG-scores

ESG (Environmental, Social and Governance) score is a score that represents and reflects a company's ESG performance based on publicly published information such as information from the company's website, financial reports or annual reports(refinitiv). The amount of companies reporting environmental data has increased distinctly over the past 25 years.[21]

Refinitiv uses more than 630 ESG-parameters when analyzing companies, where 186 of them, the most comparable and important ones in each industry, drive the scoring. They are grouped into ten *subcategories* of Environmental, Social and Governance pillars in Table 1 below.

[18] S. Francis Nicholson, "Price-earnings ratios", Financial Analysts Journal 16:4 (1960). pp. 43-45.
[19] Basu (1977), Kelly (2008) and Lakonishok (1994) all studied and reported the low P/E effect.
[20] Rolf W Banz & William J Breen, "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." The Journal of Finance 41:4 (1986). pp. 779-793.
[21] Youngtae Yoo, "Non-Financial Environmental Responsibility Information, Information Environment, and Credit Ratings: Evidence from South Korea", Sustainability 13:3 (2021), pp.1-18.

Table 1: ESG groups and subcategories.[22]

Pillars	Subcategories	Numbers of Measures
Environmental	Resource use	20
	Emissions	28
	Innovation	20
Social	Workforce	30
	Human rights	8
	Community	14
	Product responsibility	10
Governance	Management	35
	Shareholders	12
	CRS strategy	9
		Total 186

The actual calculation of the ESG score is carried out by Refinitiv in several steps. Each subcategory shown in Table 1, which is based on several parameters is assigned a score, which is then weighted, depending on the industry, and then combined into three pillar scores. They are then combined into a final ESG score, presented. How much weight is given to each category depends on which industry the company belongs to. Social and Environmental categories are weighted differently, while governance has the same weight distribution for all companies regardless of industry.[23]

2.4. Capital Asset Pricing Model

The capital asset pricing model (CAPM) is a model that can be used to calculate the expected return for a stock given the risk free return, security beta and the excess market return. The CAPM is therefore defined as the following equation:[24]

[22] Refinitiv, Environmental, Social and Governance score from Refinitiv (Refinitiv, 2022), pp. 2-27
[23] Refinitiv 2022, pp. 2-27
[24] Fama, E. F & French, K. R, "Industry costs of equity"*Journal of Financial Economics* 43:2 (1997). pp. 153-193.

$$E(R_i) = R_f + \beta_i[E(R_M) - R_f] \quad (2)$$

Further, the CAPM can be used in regression analysis by using a modified version. In this case, the alpha and the beta of a stock or portfolio can be derived from the regression output. The modification for a CAPM regression gives the following equation:[25]

$$R_{i,t} - R_{f,t} = \alpha_i + \beta 1_{,i}(R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (3)$$

α: Stock's abnormal return (the intercept of the regression)[26]
β: Stock's risk (the slope of the regression)
R_f: Risk free interest rate
R_m: Return of the market
ε: Error term

A random selection of stocks for a buy and hold portfolio should be expected to generate an alpha (the intercept of the CAPM regression) value of zero. A positive alpha means that the stock or portfolio has achieved a risk adjusted return that is higher than the market while a negative alpha means that the risk adjusted return was lower than the market.[27]

CAPM is used by a wide range of sectors to price the market. Despite this, there are criticisms of the model such as that it assumes unhindered risk-free rate lending or that investors only care about risk and return during a single period's return. The model is recommended to be used with caution when calculating the rate of return.[28]

2.5. Diminishing Effects of Market Anomalies

When examining stock anomalies that have been around for a long time there have been studies that have found that the effects of these anomalies have diminished over time. For example, when examining the January effect Mehdian and Perry found that the abnormality was existent

[25] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38.
[26] Michael C. Jensen, "Problems In Selection of Security Portfolios", The Journal of Finance 23:2 (1968), pp. 389-415.
[27] Jensen 1968, pp. 389-415.
[28] Mona A Elbannan, "The capital asset pricing model: an overview of the theory", *International Journal of Economics and Finance* 7:1 (2015), pp. 216-226.

between 1964 and 1987 but could not conclude that returns were different from zero after 1987.[29] Similarly, results of diminishing effects were also found by Marquering et al. regarding not only the January effect, but for several other well known market abnormalities such as the size effect, turn-of-the-month effect, and the weekend effect among others.[30] Further, Shanaev and Ghimire suggest that the results from their study show that as academic research increases on an abnormality, the effects of the abnormality are decreased.[31] Because of this, when examining an anomaly such as the low PE effect, which has been researched for an extensive period of time, the effect might not exist when using recent data or the effect could be severely weakened.

[29] Seyed Mehdian & Mark J. Perry, "Anomalies in US equity markets: A re-examination of the January effect", Applied Financial Economics 12:2 (2002). pp. 141-145.
[30] Wessel Marquering, Johan Nisser & Toni Valla, "Disappearing anomalies: a dynamic analysis of the persistence of anomalies", Applied Financial Economics 16:4 (2006). pp. 291-302.
[31] Savva Shanaev & Binam Ghimire, "Efficient scholars: academic attention and the disappearance of anomalies", The European Journal of Finance 27:3 (2021). pp. 278-304.

3. Previous Research

In this chapter a review of previously conducted research is presented. Both research focusing on PE-ratios and ESG-scores are reviewed as these subjects are vital to the thesis. Further, a brief summary is given on the findings of the presented research which is then connected to this thesis' hypotheses.

3.1. PE-ratios

Research examining the relationship between PE-ratios and financial performance has been conducted for a long time, with many of the studies reviewed in this thesis being conducted in the second half of the 20th century. Nicholson's two-part study from 1960 examined this relationship, showing results indicating a low PE-effect. The first part focused on the prices and PE-ratios of 100 common stocks in five year intervals from 1939-1959, showing that companies with low PE-ratios appreciated more than then companies with high PE-ratios. The second part of the study examined 29 chemical stocks' price appreciation between 1937 and 1959 with results showing that the lower half of the multiples averaged 50% higher appreciation than the higher half. Thus, with respect to these results Nicholson concluded that a low PE-effect existed.[32] This conclusion was later reinforced by Basu in 1977 who used CAPM regressions to test which of five portfolios based on PE-ratios performed best. The portfolios tested included approximately 100 firms for each year as the study incorporated 14 years of data from a total of 1400 firms traded on the NYSE between 1957 and 1971. The results of Basu's study not only provided evidence of the low PE portfolios yielding higher returns than the high PE portfolios, but it also showed that the higher returns were not associated with higher risk.[33]

The results from Basu's study were however questioned by Banz and Breen in 1986. The study found that the effect of low PE-ratios generating higher returns was clear when the current COMPUSTAT file was used as the source. This COMPUSTAT file was the one Basu had used in his study.[34] However, this was not the case when using a sequentially collected COMPUSTAT file. Because of this, the study suggested that ex-post-selection bias and look-ahead bias were the reasons for the low PE-effect. Therefore, the study concluded that by using

[32] S. Francis Nicholson, "Price-earnings ratios", Financial Analysts Journal 16:4 (1960). pp. 43-45.
[33] S Basu, "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 (1977), pp. 663-682.
[34] Basu 1997, pp. 663-682.

the current COMPUSTAT file when making portfolios would increase the likelihood of putting companies with high returns into portfolios with low PE-ratios and companies with low returns would more likely be put in portfolios with high PE-ratios.[35]

However, in a study by Lakonishok et al. in 1994 it was again shown that a low PE effect existed, even when accounting for look ahead bias. This study looked at data covering stocks from 1963 to 1990 to create portfolios based on a variety of performance measures for each year.[36] The stocks of the portfolios were equally weighted and annual price performance up to five years were measured to capture the effects of long term investing. Results showed that low earnings per price ratio stocks underperformed high earnings per price ratio stocks.[37] Also, evidence that the high earnings per price ratio stocks were more risky could not be found.[38]

Looking at studies conducted in the 21st century, evidence of a low PE effect is found yet again. Trevino and Robertson used regression analysis to show that a statistically significant negative relationship existed between returns and PE-ratios when the holding period was 2-, 5-, 8- or 10-years. However, for a 1-year holding period the relationship was not statistically significant.[39] Kelly et al. provide a similar study to the previously mentioned Basu, but with a more refined process in the regressions. The data used are industrial companies listed on the Australian market between 1998 and 2006 where portfolios based on PE-ratios are used. The findings of the study showed that the portfolios with low PE-ratios had better performance compared to the market than the portfolios with high PE-ratios. It was also found that by applying a business failure prediction model, the returns of low PE-ratios portfolios increased.[40] Lastly, a study by Sun examined several multiples and their possibility to predict returns for Australian stocks, where the PE-ratio was one of them. The sample consisted of 153 companies from various sectors and CAPM was used to capture the stocks expected returns.

[35] Rolf W Banz & William J Breen, "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." The Journal of Finance 41:4 (1986). pp. 779-793.
[36] One of the performance measures being earnings/price-ratio (E/P-ratio)
[37] The inverse of E/P-ratio being the PE-ratio. Meaning that high PE-ratio underperformed low PE-ratio.
[38] Josef Lakonishok, Andrei Shleifer & Robert W Vishny, "Contrarian Investment, Extrapolation, and Risk", The Journal of Finance 49:5 (1994). pp. 1541-1577.
[39] Ruben Trevino & Fiona Robertson,"P/E ratios and stock market returns", Journal of Financial Planning 15:2 (2002). pp. 76-84.
[40] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38.

The results showed that PE-ratio in the short term had no predictability. However, long term (3-5 years), stocks with lower PE-ratios tended to perform better.[41]

3.2. ESG-scores

When looking at research on ESG-scores and financial performance, the availability of relevant studies is more centered around recent years. Friede et al. provide a good summary of the general conclusion on ESG and financial performance. It is a review study which aimed to provide an insight into whether or not ESG positively impacts financial performance. This was done by gathering the data of 60 previous review studies that examined the relation between ESG and corporate financial performance (CFP). Through these 60 review studies, over 2200 primary studies have been researched with the conclusion being that the majority of studies on the ESG and CFP relation are positive.[42] Kumar et al. supports this in their study from 2016, which aimed to establish the connections between ESG performance and volatility of stock returns. A total of 157 firms representing the firms with good ESG performance were selected from the DJSI while the opposite side was represented by 809 randomly selected firms not listed on the sustainability index. In order to reduce the influence of factors other than ESG, the study focused on short-term indicators. The model showed higher risk-adjusted returns and less volatility from the firms with better ESG factors.[43]

In a study by Fatemi et al. it was however shown that not all three ESG factors were equal regarding contributions to firm value. This study researched if the ESG performance and the ESG-related disclosure of firms had an effect on value. By looking at 403 US firms between 2006 and 2011, the results of this study showed that firms with good social and governance performance did not have increased firm value. However, firms with good environmental performance showed increased firm value. Regarding firms with low performance in either of the three categories, the results indicated that low performance would decrease firms value. Further, the study also showed that high ESG disclosure would lead to a decrease in the positive

[41] Lan Sun,"Information Content of PE Ratio, Price-to-book Ratio and Firm Size in Predicting Equity Returns", International Conference on Innovation and Information Management Vol. 36 (2012). pp. 262-266.
[42] Gunnar Friede, Timo Busch & Alexander Bassen, "ESG and financial performance: aggregated evidence from more than 2000 empirical studies", Journal of Sustainable Finance & Investment 5:4 (2015). pp 210-227.
[43] N. C. Ashwin Kumar, Camille Smith, Leïla Badis, Nan Wang, Paz Ambrosy & Rodrigo Tavares, "ESG factors and risk-adjusted performance: A new quantitative model", Journal of Sustainable Finance & Investment 6:4 (2016), pp. 292-300.

effect on firm value if the total ESG-score was high, and a decrease in the negative effect on firm value if the total score was low.[44]

The positive effect of high ESG scores on performance could also be shown by Boido et al. in 2022. The study examined whether portfolios composed of stocks from the European market with a high ESG score performed better than portfolios composed of stocks with a low ESG score. In addition, the study investigated whether the performance was driven by specific market sectors. The research was also done on three types of ESG scores. Results showed that for both a one-year and a five-year analysis, the portfolios with higher ESG scores performed better. In the discussion about the results for sector-driven returns, it was however difficult to draw conclusions as there was a relatively large difference between sectors in the one- and five-year horizon.[45]

Contradicting results from the above mentioned studies were found by Zehir in 2020 when measuring the performance of ESG based portfolios in Europe. Both CAPM and the Fama-French three-factor model were used on data between 2004 and 2018. The results showed that both the high and low ESG portfolios performed worse than the market according to the CAPM regression while the Fama-French model showed that the low ESG portfolio outperformed the market.[46] Further, Luo's study from 2022, which researches the effect of ESG on UK stock returns show similar results. The study showed that when looking at stocks from 2003-2020, the portfolio of firms with low ESG-scores had better returns than the portfolio with high ESG-scores. Further, it was also shown that the environment and social categories had stronger premiums than the combined ESG premium, while the premium for government was insignificant.[47] In line with Luo, Lopez Prol and Kim also showed results of high ESG portfolios performing worse than portfolios that were not deemed sustainable. High ESG portfolios had lower volatility but this was not enough to compensate for the worse returns, giving these portfolios a lower Sharpe-ratio. The data consisted of yearly ESG-scores and daily

[44] Ali Fatemi, Martin Glaum & Stefanie Kaiser, "ESG performance and firm value: The moderating role of disclosure", Global Finance Journal Vol.38 (2018). pp. 45-64.
[45] Claudio Boido, Paolo Ceccherini & Alessia D'Imperio, "ESG Scores-Is it the new way to build a European portfolio?", Journal of Finance and Investment Analysis 11:3 (2022), pp. 1-21.
[46] Emre Zehir & Asli Aybars, "Is there any effect of ESG scores on portfolio performance? Evidence from Europe and Turkey", Journal of Capital Markets Studies 4:2 (2020). pp. 129-141.
[47] Di Lou,"ESG, liquidity, and stock returns", Journal of International Financial Markets, Institutions and Money Vol.78 (2022). pp. 1-20.

stock returns from the NYSE between 2018-2019. Because of the short timeframe in this study, research over longer time periods was however advised in regards to future research.[48]

3.3. Hypothesis development

To develop the hypotheses used in the methodology of this thesis, inspiration has been taken from the previous research mentioned above. The general conclusion of this research regarding the relationship between returns and PE-ratios or ESG-scores seems to indicate that a relationship exists, being a negative one for PE-ratios and a positive for ESG-scores. However, data used is largely different between research. This is because the timeframe and market researched for the presented studies differ. Further, differences in methodology exist as for example Basu uses CAPM regressions while Boido et al. compare portfolios using the Sharpe ratio.[49] It is therefore still of interest to statistically prove if a relationship exists for the dataset used in this thesis. Further, Kelly et al. compare different portfolio strategies by testing for differences in mean excess returns between the portfolios.[50] As this thesis is aimed at testing which investment strategy is the best, this closely follows this thesis aim. Lastly, the methods used by Basu, Kelly et. al., and Zehir provide grounds on whether high enough risk adjusted returns in order to beat the market have been detected in their studies.[51] Inspiration has been taken from these studies to further test whether PE investing or ESG investing can beat the market.

The following null hypothesis have therefore been established to help answering the thesis research question:

[48] Javier López Prol & Kiwoong Kim, "Risk-return performance of optimized ESG equity portfolios in the NYSE", Finance Research Letters Vol.50 (2022). pp. 1-8.
[49] Claudio Boido, Paolo Ceccherini & Alessia D'Imperio, "ESG Scores-Is it the new way to build a European portfolio?", Journal of Finance and Investment Analysis 11:3 (2022), pp. 1-21. ; S Basu, "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 (1977), pp. 663-682.
[50] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38.
[51] Basu (1977), Kelly et al. (2008) and Zehir (2020) used CAPM regressions as a base for their results.

Table 2: Hypotheses tested.

	Null Hypothesis
Hypothesis 1a)	H0: There is no relationship between PE-ratios and annual returns.
Hypothesis 1b)	H0: There is no relationship between ESG-scores and annual returns.
Hypothesis 2a)	H0: There is no difference in mean excess returns between the low ESG portfolio and the high ESG portfolio.
Hypothesis 2b)	H0: There is no difference in mean excess returns between the low PE portfolio and the high PE portfolio.
Hypothesis 2c)	H0: There is no difference in mean excess returns between the low PE portfolio and the high ESG portfolio.
Hypothesis 2d)	H0: There is no difference in mean excess returns between the high PE portfolio and the low ESG portfolio.
Hypothesis 2e)	H0: There is no difference in mean excess returns between the high PE portfolio and the high ESG portfolio.
Hypothesis 2f)	H0: There is no difference in mean excess returns between the low ESG portfolio and the low PE portfolio.
Hypothesis 3a)	H0: There is no difference in risk adjusted returns between the low ESG portfolio and the market.
Hypothesis 3b)	H0: There is no difference in risk adjusted returns between the high ESG portfolio and the market.
Hypothesis 3c)	H0: There is no difference in risk adjusted returns between the low PE portfolio and the market.
Hypothesis 3d)	H0: There is no difference in risk adjusted returns between the high PE portfolio and the market.

4. Methodology

In this chapter the methodology aimed to answer the thesis' research question and hypotheses are described together with model specifications. Necessary robustness tests that have been conducted are also presented. Note that for this thesis, three different methods have been applied to attempt to answer the research question and the hypotheses presented in chapter 1 and chapter 3, respectively.

4.1. Relationship Regression

To test hypothesis 1 on whether there is a statistically significant relationship between annual returns and ESG-scores or PE-ratios, a regression analysis has been done using Stata. For this regression, The independent variables were the ESG-score and the PE-ratio of each firm for every year between 2010 and 2022. The dependent variable was the following annual return for each firm. This regression follows the methodology of Trevino and Robertson who conducted a similar regression testing the relationship between returns and PE-ratios.[52] However, some changes have been made to fit this thesis better while still providing accurate results. Instead of examining multiple holding periods, this thesis focuses on a 1-year holding period with grounds on Trevino and Robertsons own comments regarding the interpretation when using longer holding periods. The issue being that longer holding periods can provide inaccurate results as a problem of overlapping periods becomes present in the data used.[53] Further, a log-log multiple variable regression was constructed. The decision to use logarithmic variables was made since this is a common method to use for linear regression models when dealing with variables that have a nonlinear relationship.[54] Therefore, to provide more accurate results, all variables were logarithmically transformed. This does however pose a problem with regards to the annual returns as negative values can not be transformed. To account for firms with negative annual returns, a constant of one was added for the log-transformations which ensures that companies with returns as low as negative 99% would be included in the model.[55]

[52] Ruben Trevino & Fiona Robertson,"P/E ratios and stock market returns", Journal of Financial Planning 15:2 (2002). pp. 76-84.
[53] Trevino & Robertson 2002. pp. 76-84.
[54] Kenneth Benoit, "Linear Regression Models with Logarithmic Transformations", London School of Economics 22:1 (2011). pp. 1-8.
[55] Christophe Bellègo, David Benatia & Louis Pape, "Dealing with Logs and Zeros in Regression Models", arXiv preprint arXiv:2203.11820 (2022). pp. 22-33.

4.1.1. Model Specification

The model specification for the relationship regression model is specified as:

$$\log(1+\text{Return}_{i,\,t+1}) = \beta 0 + \beta 1 \log(1+\text{ESG}_{i,\,t}) + \beta 2 \log(1+\text{PE}_{i,\,t}) + \varepsilon_{i,\,t} \quad (4)$$

With $\text{Return}_{i,\,t+1}$ being the total 52 week annual return of the following year, $\beta 0$ being the intercept, $\text{ESG}_{i,\,t}$ being the ESG-score of firm i for a specific year, $\text{PE}_{i,\,t}$ being the PE-ratio of firm i for a specific year, and $\varepsilon_{i,\,t}$ being the unobserved variables for the model.

4.2. Portfolio Allocation

For the other two methods mentioned below, portfolios were created based on the sample of firms that met the criteria for each year.[56] In total, four portfolios were created, two based on companies ESG-scores and two based on PE-ratios. The portfolios consist of the bottom 20% and the top 20% of companies based on their ESG-scores or PE-ratios. With respect to the fact that most studies differ in total number of portfolios, these four were selected as this thesis focuses on the top and bottom of ESG-scores and PE-ratios respectively. Further, Basu states in his study that portfolio distribution and number of portfolios is entirely arbitrary.[57] For the portfolio returns, monthly returns were calculated where each stock was given an equal weight against each other. Further, the stocks in each portfolio were only held for one year, meaning that new portfolios were created for each year. Both of these above decisions follow that of Kelly et al. which this methodology is largely based on.

4.3. Portfolio Comparison

To test the second hypothesis regarding if there are any differences in mean excess returns between the portfolios, a portfolio comparison has been conducted similarly to Kelly et al.[58] For this comparison, the monthly excess returns have been calculated for each portfolio for the given time frame.[59] After this, student's t-tests have been conducted to test whether the mean excess returns of each portfolio differs from one another or not. In total, six t-tests were made to compare each portfolio against the others.

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[56] See chapter 5, *Data* for how the sampling was conducted.
[57] S Basu, "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 (1977), pp. 663-682.
[58] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38.
[59] The time frame is specified in chapter 5, *Data*.

4.4. CAPM Regressions

The third and last hypothesis tested revolves around whether the portfolios have been able to generate risk adjusted returns high enough to beat the market. To test this, four CAPM regressions have been made in Stata, one for each portfolio. This follows the methodology of Basu, Kelly et al., and Zehir who have all used CAPM regressions to test similar hypotheses.

4.4.1. Model Specification

The model specification for the CAPM regression is specified as:[60]

$$R_{i,t} - R_{f,t} = \alpha_i + \beta 1_i (R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (5)$$

With $R_{i,t} - R_{f,t}$ being the excess return of portfolio i, α being the Jensen's alpha which provides information on the risk adjusted return, $\beta 1_i$ being the beta of portfolio i which measures the level of systematic risk, $R_{m,t} - R_{f,t}$ being the market's excess return, and $\varepsilon_{i,t}$ being the unobserved variables for the model.

4.5. Robustness Tests

This thesis has also applied several robustness tests to ensure that as accurate results as possible have been put forward.[61] In total, four main issues when conducting regression analyses have been identified and controlled for. These are explained in the following subsections.

4.5.1. Multicollinearity

One issue that can arise when using multiple independent variables in regression analyses is multicollinearity. This is present in regressions where the independent variables have a high correlation and can cause the standard errors of the variable coefficients to be misleading.[62] This can in turn lead to significant variables being interpreted as insignificant in the model instead. This issue therefore applies to the relationship regression model as it incorporates two independent variables. To ensure that ESG-scores and PE-ratios do not correlate strongly

[60] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38.
[61] This follows the procedures of Basu (1977) and Kelly (2008) among others.
[62] Jamal I Daoud,"Multicollinearity and regression analysis", Journal of Physics: Conference Series 949:1 (2017). pp. 1-5.

enough to generate incorrect interpretations, variance inflation factors (VIF) have been used for the relationship regression model.[63]

4.5.2. Heteroscedasticity

Another issue that has to be addressed when conducting regression analysis is the assumption of homoscedasticity. Homoscedasticity is considered to be present in regression errors when the errors have a constant variance.[64] If this is not the case and the homoscedasticity assumption is violated, the errors are instead considered to be heteroscedastic. In the case of heteroscedasticity, the standard errors of the coefficients will be biased and inconsistent. This will in turn lead to hypothesis testing of the coefficients being less statistically powerful, possibly providing incorrect conclusions. The Breusch-Pagan/Cook-Weisberg test has been used to test if any of the regressions were heteroscedastic. To solve the issue of heteroscedasticity, robust standard errors have been used in Stata for all regressions where heteroscedasticity was present.[65]

4.5.3. Stationarity

Lastly, the CAPM regressions have been tested for stationarity as they include time series data. This has been done since when using time series data, nonstationarity can lead to misleading interpretations of the results.[66] Following Kelly et al. the Augmented Dickey-Fuller test has therefore been used to confirm that the time series data for each CAPM regression was stationary.[67]

[63] Daoud 2017, pp. 1-5.
[64] Andrew F Hayes & Li Cai, "Using heteroskedasticity-consistent standard error estimators in OLS regression: An introduction and software implementation", Behavior research methods 39:4 (2007). pp. 709-722.
[65] Mohammad Ali Mansournia, et al.,"Reflection on modern methods: demystifying robust standard errors for epidemiologists", International Journal of Epidemiology 50:1 (2021). pp. 346-350.
[66] Radu Manuca & Robert Savit, "Stationary and nonstationary in time series analysis", Physica D (1996). pp. 134-161.
[67] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38 .

5. Data

In this chapter the data used for the methodology is described. The dataset used, sample criteria, and timeframe are motivated and potential biases in the dataset are discussed. Further, the variables used in the methodology are also explained.

5.1. The Sample

The empirical analysis used to answer the research question of the thesis requires a significant amount of data to be collected to act as a sample of the population. To collect the data necessary, Refinitiv Eikon has been used, comprising a total of 1957 American firms who have been publicly traded for a minimum of 1 year between April 2010 to April 2022. The usage of American firms for the sample was based on the American markets having a more extensive quantity of firms with the targeted variables. With regards to the selected timeframe, this has been selected due to how far back in time relevant variables have been available. Comparing this to previous studies, a timeframe of 12 years has been considered to be enough as multiple studies have used datasets of similar range. Further, the data has been gathered for every year between the first of April to the end of March the following year in order to minimize the possibility of look ahead bias.

5.2. Look ahead bias

The issue of look ahead bias is an issue when using financial databases as the data disclosed for a specific time would not have been accessible for investors during that time. This is because it most likely would be reported at a later date.[68] This is particularly an issue with regards to data that is calculated from firms' annual reports as they comprise information about the previous fiscal year, but are not made available for investors simultaneously as the fiscal year ends. This issue therefore applies to ESG-scores as well since Refinitiv Eikon displays ESG-scores for each year without taking into consideration when that score was made publicly available. Using the first of January as the starting point for annual returns based on ESG-scores could then be misleading since this would assume that the scores were available for investors at that time, which they would not have been. To avoid this bias, the first of April has

[68] Rolf W Banz & William J Breen, "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." The Journal of Finance 41:4 (1986). pp. 779-793.

been used since within three months of the fiscal year end, more than 90 percent of firms have released their annual reports on their financial state.[69]

5.3. Survivorship Bias

Another bias that can occur when dealing with historic datasets is Survivorship bias. This occurs when a dataset or sample excludes companies that have delisted during the research period, either because of mergers/acquisitions or because of the company going bankrupt.[70] For this thesis, survivorship bias has not been accounted for. This is because Refinitiv does not show whether a firm has delisted because of going bankrupt or if it has delisted because of being acquired by another company. This makes it difficult and time consuming to account for this type of bias since one would have to manually look into each delisted company in the dataset used. Because of the short timeframe for writing this thesis, this was not deemed possible and therefore survivorship bias has not been accounted for.

5.4. Cleaning the data

When cleaning the data there have been certain criterias that have caused firms to be excluded from the final sample. First, companies with missing data points during the time period being studied are completely excluded from the study as. Second, only companies with positive PE-ratios are included in the data set. This decision was made with regards to Lakonishok who argues that negative PE-ratios cannot be interpreted in terms of expected growth.[71] Third, companies with missing dividend data are excluded from the study as the dividend represents a part of the investments total return. Therefore excluding dividends when calculating returns could cause skewed results. All companies that showed information were included, meaning that companies with 0% dividend yields were included in the final sample.

5.5. Variables

The variables that have been used for the three different tests presented in the methodology are described as the following:

[69] S Basu, "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 (1977), pp. 663-682.
[70] Rolf W Banz & William J Breen, "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." The Journal of Finance 41:4 (1986). pp. 779-793.
[71] Josef Lakonishok, Andrei Shleifer & Robert W Vishny, "Contrarian Investment, Extrapolation, and Risk", The Journal of Finance 49:5 (1994). pp. 1541-1577.

Return

The returns used in the relationship regression model consists of the total 52 week return for a stock, thus making it an annual return. It is calculated as the percentage change in price from the starting date to the end date. Further, it includes any relevant dividend information if available.[72]

ESG-score

The ESG score used throughout all tests is an overall score for the company's environmental, social and governance pillars. The score is based on self-reported information from the company, which Refinitiv uses for calculation.[73]

PE-ratio

The PE-ratio used throughout all tests is the regular PE-ratio, calculated as the fiscal period's close price, in this case the end of March, relative to the earnings per share excluding extraordinary items.[74]

Excess return

The excess returns have been used in the portfolio comparison and in the CAPM regressions and have been calculated as the difference between the portfolio's monthly return and the one month US treasury bill return.

Excess market return

The excess market returns have been used in the portfolio comparison and in the CAPM regressions and have been calculated as the difference between the monthly return of the market and the one month treasury bill return. The market used is a collection of CRSP firms with a *CRSP share code* of 10 or 11 at the beginning of each month, fully covered data of return, price and shares, listed on the US exchanges; AMEX, NYSE or NASDAQ.[75]

[72] Refinitiv, Screener, n.d., https://emea1-apps.platform.refinitiv.com/web/Apps/ScreenerApp [Retrieved 2023-04-14].
[73] Refinitiv, Screener.
[74] Refinitiv, Screener.
[75] Kenneth R. French, Data Library, Current Research Returns, n.d., http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research [Retrieved 2023-05-02].

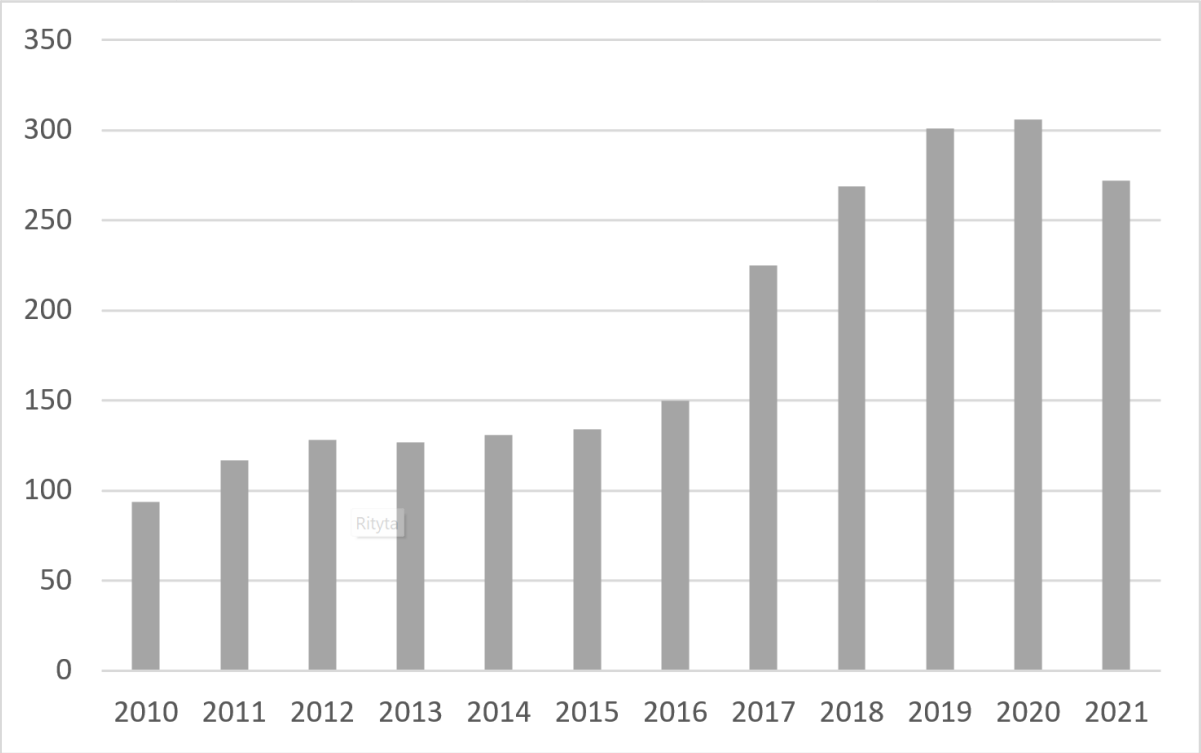
6. Results & Analysis

In this chapter descriptive statistics, the results of the robustness tests, as well as the results of the three methods are presented and analyzed. The analysis of each method begins with examining if the null hypotheses stated in chapter 3 are rejected and then continues by comparing the results to the previous research. Further, the results are also analyzed with regards to the theoretical framework. Finally, potential limitations of this study are presented.

6.1. Descriptive statistics

Below, summary statistics are shown, starting with figure 1, which shows the number of firms included in each portfolio for each year.

Figure 1: Number of firms per portfolio in each year



As presented in the method section, the portfolios each make up 20% of the total sample of companies from each year. As the amount of firms meeting the sample criteria increased as the dataset got closer to present times, the amount of firms in each portfolio also increased. The year with the highest number of firms in each portfolio was 2020.

In table 3 and table 4 below, the minimum, maximum and average values of PE-ratios and ESG-scores are shown for each year and portfolio.

Table 3: Minimum, maximum and average PE-ratio for each portfolio for each year.

	Portfolio					
	PE-low			PE-high		
Year	Min	Mean	Max	Min	Mean	Max
2010	1,3	8,7	12,1	29,6	102,1	1141,8
2011	1,5	8,4	12,1	26,2	69,2	767,2
2012	1	7,3	10,1	24	117,2	2729
2013	1,2	8,4	11,1	25,8	99,9	3336,8
2014	2,2	10,5	14	31,3	142,6	7107,5
2015	1	10,5	14,4	29,6	73,7	1145,7
2016	1,9	9,9	13,5	32,3	111,1	3110,1
2017	1,3	11,6	15,3	34,4	102,1	2033,7
2018	1	11,6	15,8	38,1	122,1	1913
2019	0,7	7,9	7,9	32,7	169,9	10963,9
2020	0,7	9,4	9,4	39,5	275,1	22966,3
2021	0,8	8,7	12,1	50,1	302,1	11690,2

Table 4: Minimum, maximum and average ESG score for each portfolio for each year.

	Portfolio					
	ESG-low			ESG-high		
Year	Min	Mean	Max	Min	Mean	Max
2010	2,4	16,8	23,2	60	73	91,3
2011	2,5	18	25	64,2	74,3	94,9
2012	2,8	17,9	25,3	63,5	74,8	95,2
2013	2,3	18	25,9	65	74,1	92,5
2014	1,8	18,9	26,5	65,2	73,8	91,3
2015	2	19,8	28,5	64,9	74,2	92,3
2016	1,6	19,5	27,7	61,5	72,3	92,4
2017	1,3	17,2	23,5	59,6	70,6	92,8
2018	3,6	18,5	24,7	60,1	71,4	91,3
2019	4,7	18,7	25,4	61,3	72,4	91,8
2020	3,8	19,6	25,6	63,2	73,3	93,2
2021	4,1	22	28,8	65,4	74,9	93,7

As can be seen in table 3 and 4, the ESG score is relatively stable around the same mean value throughout the period examined. However, there is a greater difference in the mean values of the PE numbers over the years. The data that mainly differs from the mean values are the maximum PE values in the last two years as outliers were not removed from the sample.

In table 5, the average monthly returns for each portfolio and year are shown. Further, the average return over the entire period is also displayed.

Table 5: Average monthly return for each portfolio for each year.

	Portfolio			
Year	**PE-low**	**PE-high**	**ESG-low**	**ESG-high**
2010	1,76%	2,21%	2,21%	1,50%
2011	0,45%	0,47%	0,65%	0,59%
2012	1,41%	1,46%	1,60%	1,32%
2013	2,36%	1,75%	2,24%	1,65%
2014	0,79%	1,00%	0,68%	0,87%
2015	-0,23%	0,01%	0,05%	0,39%
2016	1,89%	1,10%	1,63%	1,47%
2017	1,07%	1,09%	1,06%	1,03%
2018	0,04%	1,25%	0,62%	0,66%
2019	-3,89%	-2,02%	-3,08	-2,20%
2020	8,39%	6,41%	7,41%	6,02%
2021	0,67%	0,11%	-0,10%	1,09%
Average monthly return	**1,23%**	**1,24%**	**1,25%**	**1,20%**

Looking at table 5 it can be seen that the average monthly returns over the entire period are very similar between the portfolios, with just a 0,05% difference between the worst and best performing portfolio.

Figure 2: 1-month US treasury bill rate for each year.

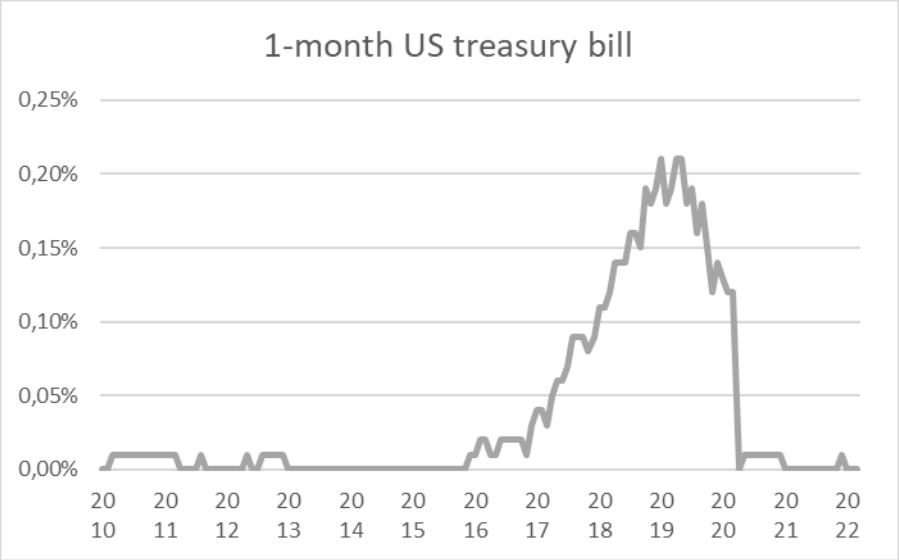


Figure 2 above presents the risk-free interest rate used in the study to calculate the excess return. As can be seen from the figure, the risk-free interest rate peaks in 2019. This can be compared with the portfolios that in the same year had their worst non-risk-adjusted return during the entire period examined, as shown in Table 3. Below, figure 3 shows the evolution of the market return for the researched period.

Figure 3: Market return throughout the time period, starting at 100.

As can be seen from Figure 3, the market has generated a return of just over 100% during the 12 years examined. A major fall in the market took place at the beginning of 2020, during covid, which can be compared to Figure *2* where the treasury bill also fell sharply. However, there is a clear positive trend over time.

6.2. Robustness tests

In order to ensure the confidence in the results and analyses presented later on, robustness tests have been conducted. A Breusch-Pagan/Cook-Weisberg test for heteroskedasticity was done for the relationship regression model as well as for the CAPM regressions to determine if robust standard errors had to be used.

Table 6: Breusch-Pagan/Cook-Weisberg test for heteroskedasticity for the relationship regression model.

Test statistics	**Relationship Regression Model**
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	385,30 (0,0000)

*S*tandard errors are in parentheses.

** p < 0,1, ** p < 0,05, *** p < 0,01*

As can be deduced from Table 6, a robust regression was necessary as this test rejects the null hypothesis of homoscedasticity which therefore indicates that heteroscedasticity exists within the data. In table 7 below, Breusch-Pagan/Cook-Wesberg test results are presented for the CAPM regressions.

Table 7: *Breusch-Pagan/Cook-Weisberg test for heteroskedasticity* for the CAPM regressions

Test statistics	**CAPM Regressions**			
	PE Portfolios		**ESG Portfolios**	
	PE-low	PE-high	ESG-low	ESG-high
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	31,60*** (0,0000)	3,56* (0,0591)	13,58*** (0,0002)	8,99** (0,0027)

Standard errors are in parentheses

** p < 0,1, ** p < 0,05, *** p < 0,01*

As can be deduced from *Table 7,* all CAPM regressions reject the null hypothesis of homoscedasticity at one of the three given significance levels, meaning that these were also run with robust standard errors.

Further, a *variance inflation factor (VIF) test* was done for the relationship regression model to account for multicollinearity between the two independent variables used. The result of this test can be seen in *Table 8*. Note that a result of 1,00 indicates that there is no correlation between the two independent variables and no multicollinearity is present in the regression.

Table 8: *Variance inflation Factor (VIF)* for the variables in the relationship regression

Test Statistics	Relationship Regression Model		
	PE	**ESG**	**Mean**
Variance Inflation Factor (VIF)	1,0000 (0)	1,0000 (0)	1,0000 (0)

The results in table 8 show that there exists no multicollinearity in the regression as the VIF is 1,00 for both independent variables.

For the CAPM regressions, testing for stationarity was also needed. To test for stationarity, which means that a shift in time does not result in a shift in variance, simply a trendless time series, we use the *Dickey-Fuller test for unit root*. The null hypothesis tested suggests that the time series is not stationary, meaning that a rejection of the hypothesis suggests that the data is stationary.

Table 9: *Dickey-Fuller test for unit root*

Test statistics	CAPM Regressions			
	PE Portfolios		**ESG Portfolios**	
	PE-low	PE-high	ESG-low	ESG-high
Dickey-Fuller test for unit root	-12,124***	-12,998***	-12,582***	-12,767***

** p < 0,1, ** p < 0,05, *** p < 0,01*

All portfolios' time series displayed in Table 9 show significance and therefore reject the null hypotheses, meaning that they are all stationary.

6.3. Relationship Regression Model

The results of the Relationship regression model are shown in *Table 10* and aims to explain whether there is a significant relationship between companies' annual stock returns and their ESG-scores or PE-ratios or not.

Table 10: Relationship regression model

Indepedent Variables	**Relationship Regression Model**
	Dependent variable: LogReturn
LogESG	0,0289*** (0,0088)
LogPe	0,0162*** (0,0062)
R-squared	0,0018

Standard errors are in parentheses.

** p < 0,1, ** p < 0,05, *** p < 0,01*

Looking at the variable coefficient for ESG-scores in *Table 10* it can be seen that the regression model finds a positive relationship between annual stock returns and ESG-scores. This coefficient is also statistically significant at the 1% level. Further, a positive relationship is also observed between annual stock returns and PE-ratios. Observing the p-value, this is also statistically significant at the 1% level. The variable coefficients for both are however quite small, indicating that none of the variables seem to have a strong relationship with future stock returns. The difference between the two beta coefficients is also minor which suggests that the relationship between annual stock returns and ESG-scores is close to the relationship between future stock returns and PE-ratios. It can also be noted that the R-squared for the relationship regression model is 0,0018 which indicates that only 0,18% of the stock returns variation is explained by ESG-scores and PE-ratios. For the purpose of testing the relationship between stock returns and the independent variables, this does not change the interpretation of the coefficients but it does indicate that using ESG-scores and PE-ratios to predict annual stock returns is not a precise predictive model.

Analyzing the results presented in Table 10 indicate that there is a small positive relationship between both ESG-scores and PE-ratios and future returns as both coefficients were positive and statistically significant. It can therefore be concluded that the null hypothesis 1a and 1b can be rejected and that a relationship between the variables and annual returns could be found in this dataset.

The result of ESG-scores having a positive relationship with returns is in line with Friede et.al. whose review study found that a majority of studies find a positive relationship between ESG-

scores and corporate financial performance.[76] A reason why the coefficient is so small, which would indicate that the relationship isn't very strong, could be explained by the conclusions drawn by Fatemi et.al. study. The results showed that the social and governance performance of firms did not increase firm value while good environmental performance did.[77] Considering that the total ESG-score of a firm can be affected by how well a firm performs in all three of these areas, the relationship could weaken. Firms that have high ESG-scores because of their performance in social and governance pillars would then not have increased firm value and would likely not see higher returns. This would then weaken the relationship as only firms with high ESG-scores because of their environmental performance would see higher returns. Further, Fatemi et.al. also provided evidence of high ESG disclosure lowering the positive effect that high total ESG-scores would have on firm value.[78] This could also be a reason why the relationship is rather weak if high ESG firms disclose their scores at an increased rate compared to firms with low ESG-scores.[79] As the regression model used in this thesis only focuses on the total ESG-score, the findings of Fatemi et al. could help explain the weakness of the relationship.

Looking at the coefficient between PE-ratios and annual returns, the positive relationship contradicts the theory of a low PE effect existing. Comparing this with Trevino and Robertson who conducted a similar test where the results show that the relationship was negative for all holding periods of 1-, 2-, 5-, 8-, and 10-years.[80] However, for the 1-year holding period these results were statistically insignificant. This result is in line with what Sun reported, where PE-ratios had no short term effect on returns.[81] Both these studies therefore suggest that a low PE effect is not found in the short term, which is in line with the results in this thesis. However, unlike these two, the results found here suggest that a positive PE relationship would exist instead. Again, the coefficient is small, meaning that the relationship isn't very strong however.

[76] Gunnar Friede, Timo Busch & Alexander Bassen, "ESG and financial performance: aggregated evidence from more than 2000 empirical studies", Journal of Sustainable Finance & Investment 5:4 (2015). pp 210-227.
[77] Ali Fatemi, Martin Glaum & Stefanie Kaiser, "ESG performance and firm value: The moderating role of disclosure", Global Finance Journal Vol.38 (2018). pp. 45-64.
[78] Fatemi, Glaum & Kaiser 2018. pp. 45-64.
[79] Note that no information on which firms disclose their ESG-scores at a higher rate was given by Fatemi et al. and this suggestion should therefore be seen as suggestive.
[80] Ruben Trevino & Fiona Robertson,"P/E ratios and stock market returns", Journal of Financial Planning 15:2 (2002). pp. 76-84.
[81] Lan Sun,"Information Content of PE Ratio, Price-to-book Ratio and Firm Size in Predicting Equity Returns", International Conference on Innovation and Information Management Vol. 36 (2012). pp. 262-266.

The result of no low PE effect being shown is also in line with the theory of diminishing returns from abnormalities as this could be a potential explanation as to why the effect is not found.

6.4. Portfolio comparison

The mean excess returns of each portfolio are shown in table 11. Further, the t-tests shown in *Table 12* show the results for the portfolio comparison where each portfolio's mean excess return was tested against each other, yielding a total of 6 t-tests. These t-tests aimed to answer the thesis second hypothesis, whether there exist differences in mean excess returns between the different portfolio groups or not.

Table 11: Mean excess returns of the Portfolios

Mean Excess Returns			
Portfolio			
PE-low	**PE-high**	**ESG-low**	**ESG-high**
0,0119	0,0120	0,0121	0,0116

Table 12: T-test on comparison of mean excess returns between the portfolios

Portfolio Comparison		
T-Test Results		
Hypothesis Tested	**Degrees of Freedom**	**P-Value**
2a) μESGlow = μESGhigh	265,71	0,897
2b) μPElow = μPEhigh	281,54	0,7267
2c) μPElow = μESGhigh	259	0,7959
2d) μPEhigh = μESGlow	284,39	0,816
2e) μPEhigh = μESGhigh	274,42	0,8965
2f) μPElow = μESGlow	285,25	0,9052

*** p < 0,05*

The results show that among the 4 portfolios, the portfolio based on low ESG-scores had the highest mean excess return while the portfolio based on high ESG-scores had the lowest mean excess return. Further, the high PE portfolio's mean excess return was higher than the low PE

portfolio's. Looking at the comparisons between the mean excess returns none of the results were however significant at the 5% level.

Analyzing the results of the portfolio comparison, none of the null hypotheses could be rejected for the given significance level. This means that at a 95% confidence level, the mean excess returns of high and low ESG-scores or high and low PE-ratios are not significantly different from each other. With regards to the comparison between the PE portfolios, these results are consistent with Sun who showed that PE-ratios had no predictive power on excess returns in the short term.[82] However, Kelly et. al did find a difference between low PE stocks and high PE stocks via the same methods as this thesis used.[83] The difference in results could be because of the usage of different markets however. It could also be linked to the theory about diminishing returns for market abnormalities as the timeframe examined by Kelly et al. is different from the timeframe used in this thesis. Comparing the results for the ESG portfolios with previous research suggests contradicting results as none of the reviewed studies found no differences between high and low ESG investing in terms of strictly looking at returns.[84]

Although the results for the portfolio comparison indicate that no differences exist between high and low ESG-scores or PE-ratios, it does not disprove that investing in any of the portfolios could earn investors higher returns relative to its risk.

6.5. CAPM regression

In order to investigate whether any of the portfolios could generate higher risk adjusted returns compared to the market, CAPM regressions were carried out against the benchmark index to derive Jensen's alpha for each portfolio. In total, four CAPM regressions were made, one for each portfolio, with the results being presented in *Table 13* below.

[82] Lan Sun,"Information Content of PE Ratio, Price-to-book Ratio and Firm Size in Predicting Equity Returns", International Conference on Innovation and Information Management Vol. 36 (2012). pp. 262-266.
[83] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38 .
[84] If the excess returns are equal, then the returns must also be equal.

Table 13: Jensen's *Alpha* and portfolio *Betas* for each portfolio as a result of *CAPM regressions*

Performance Measure	**CAPM Regressions**			
	PE Portfolios		**ESG Portfolios**	
	PE-low	PE-high	ESG-low	ESG-high
Jensen's Alpha (α_p) with standard errors in paranthesis	0,0054 (0,0037)	0,0062** (0,0027)	0,0059* (0,0033)	0,0064** (0,0025)
Beta (β_p) with standard errors in parenthesis	1,1315*** (0,1402)	1,0104*** (0,0610)	1,0828*** (0,1217)	0,9125*** (0,0877)
R-squared	0,6083	0,6586	0,6277	0,6715

Standard errors are in parentheses

** p < 0,1, ** p < 0,05, *** p < 0,01*

The CAPM regressions displayed in *Table 13* shows positive Alphas for each of the four portfolios where the highest Alpha was derived from the high ESG portfolio, closely followed by the high PE portfolio. Both of these portfolios' alphas were statistically significant at the 5% level, indicating that both portfolios generated abnormal returns compared to the market. Regarding the low ESG portfolio, the alpha was statistically significant at the 10% level, also indicating that an abnormal return compared to the market was present. The low PE portfolio had the lowest alpha, but this was not statistically significant at any of the tested levels of significance, meaning that the alpha was not significantly different from zero.

Looking at the beta coefficients for each CAPM regression shows each portfolio's beta, which is the measure of the portfolio's systematic risk. These are all significant at the 1% level. The high ESG portfolio has the lowest systematic risk while the low PE portfolio has the highest.

With regards to the results presented above, it can be concluded that the null hypotheses could be rejected for three of the portfolios, the high PE, low ESG, and high ESG portfolio. The null hypothesis for the low PE portfolio could not be rejected however. For a third time, a low PE effect can therefore not be concluded to exist in this thesis. The result of the high PE portfolio showing higher and significant risk adjusted returns compared to the low PE portfolio is the

opposite of what Basu's study found when using the same method.[85] One reason for this could be explained by the differences in how the PE-ratios were calculated. Basu calculates the PE-ratio as of December 31st while this thesis calculates it as of April 1st.[86] The difference in results could therefore be because of look ahead bias as mentioned by Banz and Breen. When using December 31st to calculate the PE-ratio, it assumes that the investor knew the earnings for that year during this time, which is not likely.[87] This could therefore skew the results, which is the conclusion that Banz and Breen derived in their study. However, Lakonishok did show results of a low PE effect existing while accounting for look ahead bias.[88] Comparing the results regarding the PE portfolios to other studies, the signs of no low PE effect are found by Sun for short term returns. However, this study does not find any evidence of high PE portfolios performing better than the market.

Looking at the results for the ESG portfolios, they are supported by Kumar et al. who also showed higher risk adjusted returns and less volatility for firms with better ESG factors.[89] Zehir, who also used CAPM regressions did however show that both the high and low ESG portfolios performed worse than the market in terms of risk adjusted returns.[90] Although the methodologies used are similar, Zehir looked at the European market while also dividing the portfolios based on the top and bottom 10% as opposed to this thesis 20%, which could explain the difference in results.

Further, when analyzing the portfolio comparison together with the CAPM-regressions conclusions can be drawn on why the high ESG portfolio had the highest risk adjusted returns compared to the market. The mean excess return for the high ESG portfolio was the lowest despite having the highest risk adjusted return. Because of this, the contributing factor to this result is the fact that the high ESG portfolio had the lowest amount of risk. The t-tests from the

[85] S Basu, "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 (1977), pp. 663-682.
[86] Kelly et al. also calculates PE ratios as of December 31st, showing results of a low PE effect. The analysis on the possible effects of look ahead bias therefore applies to this study also.
[87] Rolf W Banz & William J Breen, "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." The Journal of Finance 41:4 (1986). pp. 779-793.
[88] Josef Lakonishok, Andrei Shleifer & Robert W Vishny, "Contrarian Investment, Extrapolation, and Risk", The Journal of Finance 49:5 (1994). pp. 1541-1577.
[89] N. C. Ashwin Kumar, Camille Smith, Leïla Badis, Nan Wang, Paz Ambrosy & Rodrigo Tavares, "ESG factors and risk-adjusted performance: A new quantitative model", Journal of Sustainable Finance & Investment 6:4 (2016), pp. 292-300.
[90] Emre Zehir & Asli Aybars, "Is there any effect os ESG scores on portfolio performance? Evidence from Europe and Turkey", Journal of Capital Markets Studies 4:2 (2020). pp. 129-141.

portfolio comparison stated that no significant differences in mean excess returns could be found between high and low ESG-scores or PE-ratios. This would indicate that creating portfolios based on ESG-scores and PE-ratios should on average yield the same excess returns between the portfolios. Combining this with the betas from the CAPM regressions would then indicate that the high ESG portfolio should on average have the highest alpha as its beta is the lowest.

Lastly, with regards to the EMH, the CAPM regressions suggest that three of the portfolios have been able to beat the semi-strong version of the EMH. This is because if the market truly took all available information into account when pricing securities, no risk adjusted returns that are high enough to beat the market systematically should exist. Since the CAPM regressions found evidence of three of the portfolios having abnormal returns, it indicates that these three portfolios have systematically beat the market. Thus suggesting that all available information was not taken into account when pricing the stocks in these portfolios.

6.6. Limitations

A key part of our limitations is that we only included companies with complete data, which in practice means that companies with no returns for a certain period are excluded from the study. These could be companies that have gone bankrupt or that left the stock market through mergers or acquisitions, resulting in a survivorship bias where only surviving companies are included. Of course, the results could have been different if these companies had been included in the study. However, since the study covers a large number of companies and the possibility of further investigation for all companies with missing data was not possible partly because of time constraints, but also due to lack of information about delisted companies in Refinitiv, the study is limited in this way. This differs from Kelly who did include companies that were delisted during the time examined.[91]

Reviewing the results from the CAPM regressions, indications of survivorship bias can be found as both the low ESG portfolio and the high ESG portfolio have achieved significant abnormal returns compared to the market. As the market that the portfolios have been compared

[91] Simone Kelly, Jenna McClean & Ray McNamara, "The low P/E effect and abnormal returns for Australian industrial firms", 21st Australasian Finance and Banking Conference (2008), pp. 1-38 .

to incorporate delisted companies but the constructed portfolios do not, there is a chance that the results are skewed in the favor of the portfolios.

Another fundamental limitation to this study is the timeframe of the portfolios' holdings. This study has been limited to a shorter term and consistently been based on one-year data where portfolios were constructed and held for one year. Sun shows that the ability to predict share price based on PE ratio and excess return over a one-year term is non-existent, but it proves that over a five-year term, companies with low PE ratios have the ability to get a higher excess return.[92] If this study had tested portfolio compositions over longer periods of time, the results could possibly have been different. However, due to time constraints, only one year holding periods were tested.

[92] Lan Sun,"Information Content of PE Ratio, Price-to-book Ratio and Firm Size in Predicting Equity Returns", International Conference on Innovation and Information Management Vol. 36 (2012). pp. 262-266.

7. Conclusion

In this chapter concluding remarks are stated while also connecting the results of the thesis to the research question stated in chapter 1. Further, remarks on possible further research is put forward.

This thesis aimed to answer whether high ESG investing is a valid investment strategy compared to low PE investing with background in the recent decades rise in ESG investment strategies. This has been researched through a series of three different tests aimed to examine the relationship between future annual returns and ESG-scores or PE-ratios, as well as the difference in excess and risk adjusted returns for portfolios based ESG-scores and PE-ratios. The results found indicate that a weak positive relationship existed between both ESG-scores and annual returns, and PE-ratios and annual returns. The portfolio comparison did not show that statistically significant differences in mean excess returns existed among high and low ESG-scores or PE-ratios. However, significant risk adjusted returns higher than the market were found for three of the four portfolios when conducting CAPM regressions. The only portfolio that did not show significant risk adjusted returns was the low PE portfolio.

The results presented in this study, therefore, contradict previous studies such as Basu's and Kelly et al. that proved the low PE-effect, which is something that did not appear for any of the three tests conducted. This could potentially be viewed as further proof on the diminishing effects of abnormalities.

With regards to ESG the results show that there is a small significant positive relationship between ESG-scores and returns. Further, the high ESG portfolio provided the highest risk adjusted returns out of all portfolios when compared to the market. This portfolio also came with the lowest amount of risk as shown by the beta derived from the CAPM regressions. This low risk compared to the other portfolios is considered to be the largest contributor to the higher risk adjusted returns as the mean excess return of the high ESG portfolio was the lowest out of all portfolios.

As a conclusion to the thesis research question, this thesis has shown that when comparing high ESG investing with low PE investing, investing in high ESG stocks will be the better option.

However, it is important to note that this thesis does not factor in potential survivorship bias, which can have skewed the results.

For further research within this area, taking into account survivorship bias is a means to further strengthen the confidence of the results. Also accounting for longer holding periods could provide important insights as to whether which strategy is preferred for long term investing. Lastly, as the results from this thesis seem to support the theory of diminishing effects of abnormalities, testing the effect of high ESG investing in the future would be a beneficial contribution with regards to this topic.

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