Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
NTNU Business School

Ida Dyrseth

Sin stock premium or not: can ESG scores add insight?

Master's thesis in MSc in Economics and Business Administration
Supervisor: Hans Marius Eikseth
May 2022

NTNU
Kunnskap for en bedre verden

Ida Dyrseth

Sin stock premium or not: can ESG scores add insight?

Master's thesis in MSc in Economics and Business Administration
Supervisor: Hans Marius Eikseth
May 2022

Norwegian University of Science and Technology
Faculty of Economics and Management
NTNU Business School

NTNU
Norwegian University of
Science and Technology

Acknowledgments

This master thesis is the final part of my master's degree in Economics and Business Administration at NTNU Business School, with major in Finance.

I wish to express my deepest gratitude to my supervisor at NTNU, Hans Marius Eikseth: thank you for many interesting discussions and vital guidance throughout the semester.

Please note that the author takes full responsibility for the content in this thesis.

NTNU Business School

Trondheim, May 2022

Ida Dyrseth

Abstract

Are investors rewarded with additional returns for holding sin stocks? As of now, there is no consensus in the literature as to whether such a sin stock premium exists. This thesis sets out to answer two related research questions: *is there a sin stock premium? Are there nuances to sin stocks when viewed through the ESG lens?* This thesis studies publicly traded companies in the alcohol, defense, gambling, and tobacco industries in the USA and selected countries in Europe. Sin stocks are studied from 2001 – 2021 and sin stocks sorted by ESG scores are studied from 2011 – 2021. In time-series regressions the CAPM, the Carhart-model and the Fama-French three- and five-factor models are applied, with combinations of the Momentum factor and the Betting-Against-Beta factor. This thesis finds no robust indications of a general sin stock premium. However, sin stocks with low ESG scores have abnormal returns and outperform sin stocks with high ESG scores. As the evidence suggests that there is no general sin premium, the abnormal returns could be related to an ESG premium. This is a contribution to the literature as this could indicate that investors demand a premium for investing in firms with lacking ESG practices.

Sammendrag

Blir investorer belønnet med meravkastning for å holde syndaksjer? Foreløpig er det ingen enighet i litteraturen om hvorvidt en slik premie for syndaksjer eksisterer. Denne oppgaven tar sikte på å svare på to relaterte forskningsspørsmål: finnes det en risikopremie tilknyttet syndaksjer? Er det nyanser til syndaksjer når de sees gjennom en ESG-linse? Denne oppgaven studerer børsnoterte selskaper innen alkohol-, forsvar-, gambling- og tobakksindustriene i USA og utvalgte land i Europa. Syndaksjer er studert fra 2001-2021 og syndaksjer sortert etter ESG-skår er studert fra 2011-2021. I tidsserieregresjoner brukes kapitalverdimodellen, Carhart modellen og Fama-French tre- og fem-faktormodeller med variasjoner inkludert faktorene Momentum og Betting-Against-Beta. Denne oppgaven finner ingen robuste indikasjoner på en generell syndaksjepremie. Imidlertid har syndaksjer med lav ESG-score meravkastning og gir høyere avkastning enn syndaksjer med høy ESG-score. Siden resultatene tyder på at det ikke er noen generell premie tilknyttet syndaksjer, kan meravkastningen være relatert til en ESG-premie. Dette er et bidrag til litteraturen da det kan tyde på at investorer krever en premie for å investere i bedrifter med manglende ESG-praksis.

Table of contents

List of tables

List of figures

1 Introduction

This thesis sets out to answer two related research questions: *is there a sin stock premium? Are there nuances to sin stocks when viewed through the ESG lens?* Sin stocks are stocks in firms that historically and across many cultures have been shunned by investors. They are usually defined as the alcohol, defense, gambling, and tobacco industries. Previous research has found that these industries in some periods have outperformed the market: Fabozzi, Ma, and Oliphant (2008) found that a global sin portfolio from 1970-2007 produced an annual return of 19.02 % compared to the average stock market of 7.87 %. Similar findings of abnormal returns made the sin stock premium hypothesis blossom: it states that investors are rewarded with additional returns for holding sinful stocks, meaning that *sin* is a priced risk factor (Hong & Kacperczyk, 2009). As of now, there is no consensus in the literature as to whether the premium exists.

In most of the literature, a firm is defined as sinful or not by its industry classification. This thesis contributes to the literature by using ESG (Environmental, social and governance) scores to investigate possible nuances to the sin label. The motivation for this can be illustrated by the business case of the tobacco company Philips Morris International and the winery and spirits company Pernod Ricard. Philip Morris International is the largest tobacco company in the United States, producing Marlboro which is the world's best-selling international cigarette. In 2016, the company announced a major business transformation: its new ambition was to be in the lead in creating a "smoke-free future". Their long-term goal is to, one day, stop selling traditional cigarettes, and replace their core business with smoke-free nicotine products. Pernod Ricard was the first alcohol-producing firm to be recognized as a UN Global Compact LEAD participant for its work on the United Nations Sustainable Development Goals (Pernod Ricard, 2018). The point of reflection is: are Philip Morris International and Pernod Ricard as sinful as other tobacco or alcohol-producing firms with no sustainability related ambitions? Although there is literature on the sin stock premium, insufficient attention has been paid to possible nuances of the sin label.

Following the research questions, four hypotheses are tested:

Hypothesis 1: sin stocks earn abnormal returns

Hypothesis 2: sin stocks with low ESG scores have abnormal returns

Hypothesis 3: sin stocks with high ESG scores have no abnormal returns

Hypothesis 4: sin stocks with low ESG scores have outperformed sin stocks with high ESG scores

The remainder of the thesis is organized as follows: Chapter 2 provides background information on sin stocks and sustainable investing; Chapter 3 provides the theoretical framework, literature review, and hypothesis development; Chapter 4 describes the data collection; Chapter 5 describes the methodology used and robustness tests; Chapter 6 presents the results of the analysis; Chapter 7 provides a discussion of the results; Chapter 8 provides a conclusion.

2 Background

2.1 Sin stocks

Sin stocks refer to firms that are involved in activities considered unethical and capitalize on human vice (Blitz & Fabozzi, 2017). There are certain variations in how the literature defines sin stocks: Salaber (2007) and Hong and Kacperczyk (2009) define sin stocks as the alcohol, tobacco, and gambling industries, whilst Blitz and Fabozzi (2017) and Sagbakken and Zhang (2022) include the defense industry in their definition as well.

What is determined as sinful is defined by the morals of the society one is perceiving. Views of the world's main religions are of importance as to what is deemed to be immoral activities. Across many religions the overindulgence in alcohol and tobacco is viewed as immoral. The Christian New Testament allows moderate use of alcohol but forbids drunkenness.[1] Most Muslims view alcohol and tobacco as forbidden, and the Quran warns against consumption.[2] The Roman Catholic Church considers excessive smoking to be sinful; In the Vatican, a ban on the sale of tobacco products became effective in January 2018 (Pullella, 2017). Many religious groups are either explicitly or implicitly opposed to gambling (Ellison & McFarland, 2011).

Religious and societal views on weapons are a bit more complex to effectively sum up. Whilst alcohol, gambling, and tobacco have similarities as they are representing a form of immoral indulgence, the mere existence of weapons creates a dilemma: most religions and societies condemn violence, but also value the right to self-defense. Regardless the religious views or opinions, all the industries selected in this thesis are associated with severe costs to society. According to the US Department of Health and Human Services (2022), 45.222 people died from gun-related injuries in the US in 2020. According to The World Health Organization (2021), smoking-related mortality has risen to more than 8 million lives annually, killing more people than AIDS, malaria, and tuberculosis combined. Governments worldwide issue alcohol guidelines to avoid alcohol-related deaths, illnesses, and abuse. The National Council on Problem Gambling

[1] For examples on verses in the Bible on alcohol and tobacco see Ephesians 5:18; Galatians 5:19-21; 1 Peter 4:3.

[2] For examples on verses in the Qurans on alcohol, tobacco and gambling see (4:43); (2:219).

(2018) estimates the national social costs of problem gambling in the USA to be up to USD 6.7 bn yearly as the consequences often are bankruptcy, job losses, and home losses.

Following the state of the literature, this thesis defines sin stocks as publicly traded companies in the alcohol, defense, gambling, and tobacco industries. There are indeed other controversial business practices and topics, but the opinions on for instance biotechnology and nuclear power are very varied cross-culturally. The sin industries chosen represent activities that are globally deemed to be immoral, and thus shunned by many investors worldwide.

2.2 Sustainable investing

The literature on sustainability and sustainable investing mainly focuses on ESG and CSR (Corporate Social Responsibility). Both are a set of criteria for a company's operations and the two concepts are related but slightly different. Gerard (2019, p. 1) provide the following definition of the terms: "CSR encompasses the first two elements of ESG, the environmental and the social conduct of the firm. ESG combines the environmental and social impact of the firm, with its Corporate Governance performance. Hence ESG is CSR plus Governance". As the ESG term is the broadest, ESG scores will be used in this thesis, however, the literature on CSR will remain relevant.

ESG information enables the investor to gain insights into material risk and growth opportunities that are not commonly part of mandatory financial reporting. This information is useful for investors who wish to take investment decisions based on the firm's impact on factors related to sustainability. Sustainable investing is an investment discipline where ESG criteria play an important role in choosing investments to generate long-term competitive financial returns whilst ensuring a positive societal impact (US SIF: The Forum for Sustainable and Responsible Investment). Hence, ESG is the foundation for sustainable investing, which often goes by other labels such as ethical investing, impact investing, and socially responsible investing.

2.3 Investor approaches to sustainable investing and sin stocks

According to US SIF (2020), USD 17.1 trillion was managed in accordance with sustainable investing strategies in the US in 2019. That is one out of every three dollars under professional management and represents a 42 % increase from 2018. The increased focus on socially responsible investing can serve as anecdotal evidence for the increased ethical focus of investors, and that

investors recognize that ESG criteria are useful to identify responsible, well-managed companies that will be long-term resilient (US SIF, 2020). In a global survey conducted on investment professionals in investment firms, Amel-Zadeh and Serafeim (2018) find that 82 % of the 652 respondents use ESG information in investment decisions with the belief that it is important for investment performance. The most predominantly used ESG investment styles found in the survey were active ownership approaches; integrating ESG information with individual stock valuation models; using ESG information for negative portfolio screening.

Whilst many investors do not find it morally acceptable to invest in firms that capitalize on the involuntary addiction of individuals, some especially seek out these firms. There are mutual funds that primarily invest in sin stocks, for instance The Vitium Global Fund founded in 2002 with assets under management of USD 107 million in 2020. According to its founder, USA Mutuals (2020), the fundamental idea is that the alcohol, defense/aerospace, gambling, and tobacco industries are defensive stocks due to their stable earnings and will provide better long-term risk-adjusted returns. In addition to mutual funds, there are also multiple exchange-traded funds specifically designed for investments in sin stocks.

3 Theoretical framework and literature review

The sin stock premium hypothesis states that investors are rewarded with additional returns for taking on sinful stocks, meaning that *sin* is a priced risk factor. Hong and Kacperczyk (2009) and Fabozzi et al. (2008), find that sin stocks historically have delivered positive abnormal returns and find robust evidence for the presence of a sin stock premium. However, others claim that the abnormal returns are due to other elements, such as characteristics of the controversial companies and industries, and not *sin* itself (Blitz & Fabozzi, 2017; Sagbakken & Zhang, 2021). In this section, the theoretical arguments for a sin stock premium and the current state of the literature regarding sin stocks and ESG/CSR are discussed.

3.1 The neglect effect

The discussion of a sin stocks premium is essentially a discussion about whether social norms and values can affect asset pricing. In the Capital Asset Pricing Model (CAPM) individual values do not play a role in asset pricing, as the asset price is determined only by the single market risk premium (Sharpe, 1964). However, Merton (1987) provides a theoretical rationale for the neglect effect. He shows that an increase in investor base can reduce the firm's cost of capital thus increasing the market value of the firm. On the other hand, firms that are neglected by investors earn higher equilibrium returns as compensation for the risk associated with limited information. Merton (1987) shows that the magnitude of the neglect effect on the cost of capital will be greatest for firms with smaller investor bases and firms with large firm-specific variances. A reduced investor base will cause the CAPM to no longer hold, meaning that idiosyncratic risk will matter in addition to the systematic risk for pricing. The paper of Hong and Kacperczyk (2009) is one of the first and most cited papers studying the effects of social norms on markets. They argued that since sin stocks often are associated with increased firm-specific variances they should have higher expected returns compared to non-sinful stocks not experiencing the neglect effect. When running time-series regression on 193 sin stocks from 1965-2006, applying a zero-net investment strategy long in sin stocks and short in non-sin comparable stocks, they found a monthly excess return of 26 bp. Hong and Kacperczyk (2009) conclude that the outperformance was due to the neglect effect combined with sin stocks "facing greater litigation risk heightened by social norms." (p. 15).

3.2 Limiting the investment universe

A portfolio obtained under the Markowitz (1952) mean-variance framework with constraints is expected to underperform a portfolio without constraints. As such, investors neglecting sin stocks from their portfolios are effectively paying an economic opportunity cost by underperforming on a risk-adjusted basis to conform to their values. The choice of investors to apply negative screening strategies is of high importance as there seem to be related opportunity costs to this. Trinks and Scholtens (2017) study the opportunity cost of negative screening (i.e., avoiding investing in firms with poor ESG characteristics). They investigate a broad sample of 1763 stocks in 14 industries from 1991-2012 that are often subjects to negative screening.[3] Their findings suggest that investing in controversial stocks often results in additional risk-adjusted returns and that depending on which industries are excluded, the investment universe can become substantially smaller. If excluding the *Sextet of Sin*[4] in the US, investors would forego more than 6 % of the investment universe in terms of market capitalization. With a basis in the S&P 500, Trinks and Scholtens (2017) find that a market portfolio with negative screening significantly underperformed an unscreened market portfolio. When studying who owns tobacco stocks, Blitz and Swinkels (2021) find that norm-constrained investors (i.e., sovereign wealth funds and pension funds) underweight or disinvest in tobacco shares. They find indications of that disinvestments among norm-constrained investors is increasing over time. Hong and Kacperczyk (2009) find that sin stocks are less held by norm-constrained investors compared to mutual funds or hedge funds, thus indicating that certain investors are willing to forego additional risk-adjusted returns to uphold their social values.

3.3 Sin stock specific variances and characteristics

Fabozzi et al. (2008) discuss sin stock specific variances and claim that due to their controversial products and effects on society, sin stocks are often prone to headline risk. Headline risk refers to the risk that news about the firm will affect the value of the stock, whether the news is true or not. Additionally, empirical findings from Hong and Kacperczyk (2009) are consistent with sin stocks facing greater litigation risk, meaning the risk that the firm may face legal actions due to its

[3] The fourteen potentially controversial subjects were: Abortion, adult entertainment, alcohol, animal testing, contraceptives, controversial weapons, fur, gambling, genetic engineering, meat, nuclear power, pork, (embryonic) stem cells, and tobacco.

[4] The Sextet of Sin refers to: Alcohol, tobacco, gambling, controversial weapons, adult entertainment, and nuclear power.

products or operations. Fabozzi et al. (2008) claim that headline risk, combined with the sin industries being prone to litigation risk, leads to a permanent discount in the valuation of sin stocks.

Recent literature has been able to shed new light on the sin anomaly by using the Fama-French five-factor model. Blitz and Fabozzi (2017) revisit the original paper of Fabozzi et al. (2008) and find that the evidence of a sin premium disappeared when controlling for the two new quality factors: profitability and investment. One of their explanations is that sin industries enjoy high margins as they have high entry barriers and are not especially regulated in terms of pricing. Additionally, they are restricted as to what extent they can grow their assets; thus, they have a conservative investment profile. As the Fama-French five-factor model was able to completely explain the performance of sin stocks they claimed that the sin stock anomaly was resolved: meaning that there was no evidence of a premium that pertains specifically to sin stocks. Sagbakken and Zhang (2022) contribute to the literature with a study on European traditional sin stocks and newer sin industries with data from 2006-2020. Their results align with Blitz and Fabozzi (2017): the sin premium was driven by the profitability and investment factors and not by sinfulness, both regarding traditional sin industries and newer sin industries.

3.4 Many shades of sin?

There are challenges with measuring social norms and sinfulness in the capital markets. Sin can be relative, what is observed as sinful in some cultures are not in others and this international variation can affect equity valuation (Fauver & McDonald, 2014). Fauver and McDonald (2014) find that sin stocks have 8 % lower equity valuation in certain countries with values strongly against sin industries. The sin stocks' excess returns were concentrated in nations classified as difficult to arbitrage[5], while they were non-significant in countries where arbitrage is relatively easy. The authors claim that the treatment of sin stocks will depend on the social norms present in the given country, which is in line with the findings of Salaber (2007) who found that sin stock returns depend on legal and cultural characteristics. She found that Protestants tend to be more "sin averse" than Catholics, thus requiring a higher risk premium than their Catholic brethren.

[5] The idea of difficult arbitrage refers to either investment restrictions, unique language barriers and significant cultural differences. Examples of nations classified as difficult to arbitrage: Brazil, Indonesia, Turkey, South Africa, and Italy. Examples of nations where arbitrage is relatively easy: the US, UK, Canada, and France (Fauver & McDonald 2014, p. 181).

The literature uses different methods for determining if a firm is sinful or not, but the main method is using broad industry definitions. Fabozzi et al. (2008) define a company as a sin stock if its revenue consists of more than 30 % from a sin industry; Hong and Kacperczyk (2009) use Fama-French industry group codes and the North American Industry Classification System; Sagbakken and Zhang (2022) use The Refinitiv Business Classification. Trinks and Scholtens (2017) argue using industry definitions is a problematic approach because broad industry codes do not capture all potential sinful involvement, as "sin" is not the basis for the industry classification. This leads to an incomplete representation of the actual investment universe of sin stocks. Effectively the literature often treat sin as a dummy variable: either a firm is a sin stock or not, and in this lies an assumption that investors evaluate firms in such a simple manner.

To give a more nuanced view of the world of sin, using ESG or CSR scores can help to view the variation of sinfulness in a sinful industry as it can gain insights into how the company is positioning itself towards meeting societies' norms and standards, and towards sustainability-related risks. When comparing ESG scores of sin stocks with comparable firms in traditional sectors Paradis and Schiehll (2021) find that sin stocks are exposed to more severe ESG issues. For instance, tobacco producers have increased exposure to the environmental pillar due to deforestation and soil degradation, combined with unsatisfactory initiatives to minimize their impacts. When studying an extensive US sample of 475 firms engaged in controversial activities from 1995-2009, Cai, Jo, and Pan (2012) find that CSR engagement positively affects the firm value of firms in controversial industries. The finding is robust after controlling for various firm characteristics. They further argue that the management engages in CSR activities to improve the long-term firm value and argue in line with what Sharma and Song (2018) call the "moral rebalancing" hypothesis. This hypothesis states that CSR engagement is an ideal mechanism for "moral rebalancing": by actively pursuing CSR, sin firms could potentially reduce the financial consequences of adverse screening by investors, as found in Hong and Kacperczyk (2009), and thus maximize firm value. Sharma and Song (2018) find that the CSR activity of sin firms is mainly driven by "Low CSR" sin firms who are operating at CSR levels below their peers and that these firms have a higher incentive to increase their CSR to increase their competitive advantage. Sharma and Song (2018) argue that this supports the hypothesis that CSR engagement could be strategically used to gain a competitive advantage ensuring that the firms' sinful products are attractive to conscious customers.

Regardless of the reasons for sin firms to conduct CSR, the literature agrees that sin firms benefit from CSR engagement through an increase in firm value (Sharma & Song, 2018; Cai et al., 2012). Jo and Na (2012) examine the relationship between CSR and firm risk for sin stocks. The results show that both total risk and systematic risk[6] are significantly and negatively related to CSR engagement, robust after controlling for multiple firm characteristics. In addition, they find that risk reduction through CSR engagement is larger and more statistically significant for firms in controversial industries than in non-controversial industries. Given these results, it is perhaps not surprising that firms in controversial industries engage in more CSR practices than firms in non-sin industries, a finding confirmed by Kotchen and Moon (2012) and Sharma and Song (2018).

In summary, the literature finds that CSR practices can enhance sin firms' value, reduce sin firms' risk to a greater extent than non-sinning firms, and that sin firms are more engaged in CSR than non-sinners. These findings are interesting as they could affect a potential sin stock premium. This thesis uses ESG scores to differentiate firms in sin industries from each other, with the intent of investigating possible nuances to the broad sin label.

3.5 Research questions and hypotheses

The first research question is as follows: *is there a sin stock premium?* Following the research question, *Hypothesis 1* is developed.

Hypothesis 1: sin stocks earn abnormal returns

As the research on sin stocks is not in agreement as to whether a sin stock premium exists, the expectations regarding this hypothesis are open.

The second research question is: *are there nuances to sin stocks when viewed through the ESG lens?* Following this, *Hypotheses 2, 3, and 4* are developed.

Hypothesis 2: sin stocks with low ESG scores have abnormal returns

If there is a sin stock premium, it is expected to be present for sin stocks with low ESG scores.

Hypothesis 3: sin stocks with high ESG scores have no abnormal returns

[6] Jo and Na (2012) measure total risk by standard deviation of daily stock returns and systematic risk is measured by the CAPM beta.

According to the moral rebalancing hypothesis, firms can use ESG and CSR practices to affect the potential negative financial consequences of adverse screening. If there are no abnormal returns for sin stocks with high ESG scores this can indicate that investors do not find these firms to be sinful.

Hypothesis 4: sin stocks with low ESG scores have outperformed sin stocks with high ESG scores

If this hypothesis is confirmed, this would imply that investors demand an additional return for investing in sin firms with low ESG scores compared to sin firms with high ESG scores. This could be due to a sin stock premium present for these firms, but it could also imply a form of ESG-related risk premium.

4 Data

There are two main samples in this thesis: the sin stock portfolio and a sin stock portfolio sorted by ESG scores. The first portfolio is measured from January 2001 – December 2021, whilst the second is only measured from January 2011 – December 2021 due to the increasing lack of ESG data further back in time. All data in this thesis are in USD.

The dataset on the Fama-French factors is retrieved from the online Kenneth French Data Library and the factors used are for "Developed Markets". [7] The sin stock sample is based on firms in the USA and the European countries included in the construction of the factors in the Developed Markets category according to the Kenneth French Data Library. These European countries are Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. The dataset on the Momentum factor was downloaded from the online Kenneth French Data Library, whilst the dataset for the Betting-Against-Beta factor was retrieved from the webpage of the global investment management firm Applied Quantitative Research (AQR). In the following sections, the total sin stock sample, and the sin stock portfolio with ESG scores are presented.

4.1 Sin stock sample

The scope of this thesis is on the alcohol, defense, gambling, and tobacco industries following Blitz and Fabozzi (2017) and Sagbakken and Zhang (2022). Data on monthly returns adjusted for dividends and monthly market capitalization is retrieved from Thomson Reuters Eikon Portal. The sample is based on The Refinitiv Business Classifications (TRBC) industry groups. See Appendix A for the TRBC ID codes used in the sample. The Aerospace & Defense group (TRBC ID 4294952964) is the industry that includes defense stocks, so stocks in this category are manually screened and only firms in the defense industry are included. There are instances where firms have been categorized in the wrong TRBC group. To avoid a non-sin firm included in the sample, the entire sample is manually screened to make sure all the firms are in fact within a sin industry. To be included in the final sample the firm must have data on both market capitalization and returns

[7] The Fama-French factor construction for Developed Markets are based on data from the following countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United States, and Australia.

for at least one data point. Table 4.1 provides a summary of number of firms in the initial sample, excluded firms and the final sample. The sample has a good representation of firms within the alcohol, defense, and gambling industries. However, there are notably fewer tobacco firms and there are over thrice as many alcohol firms as tobacco firms. Table 4.2 shows that approx. 60 % (158 out of 261) of the firms in the sample are from the US. See Appendix A B for the sin stocks in Europe by country and industry.

Table 4.1 Initial sample and final sample

	Alcohol	Defense	Gambling	Tobacco	*Total*
Initial sample	99	87	74	26	*286*
Excluded: non-sin firm[1]	*1*	*14*	*0*	*0*	*15*
Excluded: lack of data[2]	*2*	*2*	*6*	*0*	*10*
Final sample	96	71	68	26	*261*

The table presents number of firms by industry in the sample development process.
[1]The firm was excluded from the initial sample because it was categorized in the wrong TRBC group and not a firm in a sin industry.
[2]The firm was excluded due to lack of data: to be included in the final sample the firm must have data on both market capitalization and returns for at least one data point.

Table 4.2 Sample by continent and industry

	Alcohol	Defense	Gambling	Tobacco	*Total*
Europe	57	15	25	6	*103*
USA	35	56	43	24	*158*
Total	92	71	68	30	*261*

The table presents number of firms by industry and continent in the final sample.

Table 4.3 Sample by year and industry

Year	Alcohol	Defense	Gambling	Tobacco	*Total*	Year	Alcohol	Defense	Gambling	Tobacco	*Total*
2001	83	71	68	38	*260*	2012	61	60	48	20	*189*
2002	78	68	66	33	*245*	2013	60	59	47	21	*187*
2003	78	66	65	32	*241*	2014	57	56	43	19	*175*
2004	76	66	61	31	*234*	2015	53	52	41	16	*162*
2005	74	64	59	31	*228*	2016	52	48	40	14	*154*
2006	74	63	58	29	*224*	2017	48	43	37	13	*141*
2007	73	64	56	27	*220*	2018	44	41	30	12	*127*
2008	70	63	55	27	*215*	2019	44	40	28	11	*123*
2009	68	63	54	25	*210*	2020	39	38	28	11	*116*
2010	65	62	51	23	*201*	2021	38	35	25	10	*108*
2011	64	62	47	22	*195*						

The table shows how the number of firms in the final sample has developed with time.

Table 4.3 shows a declining number in the number of sin firms in the sample. In 2001, there were 260 sin stocks, and in 2021 there were only 108. This strong downward trend is visible in Figure 4.1 and Figure 4.2. The market capitalization of the sin portfolio has been declining throughout the sample period. In Figure 4.1, the decline in the alcohol industry is especially noticeable: it went from being the largest industry by market capitalization in 2001, to the third largest in 2021. Figure 4.2 shows that the trend has been similar for the sin stocks in Europe and USA.

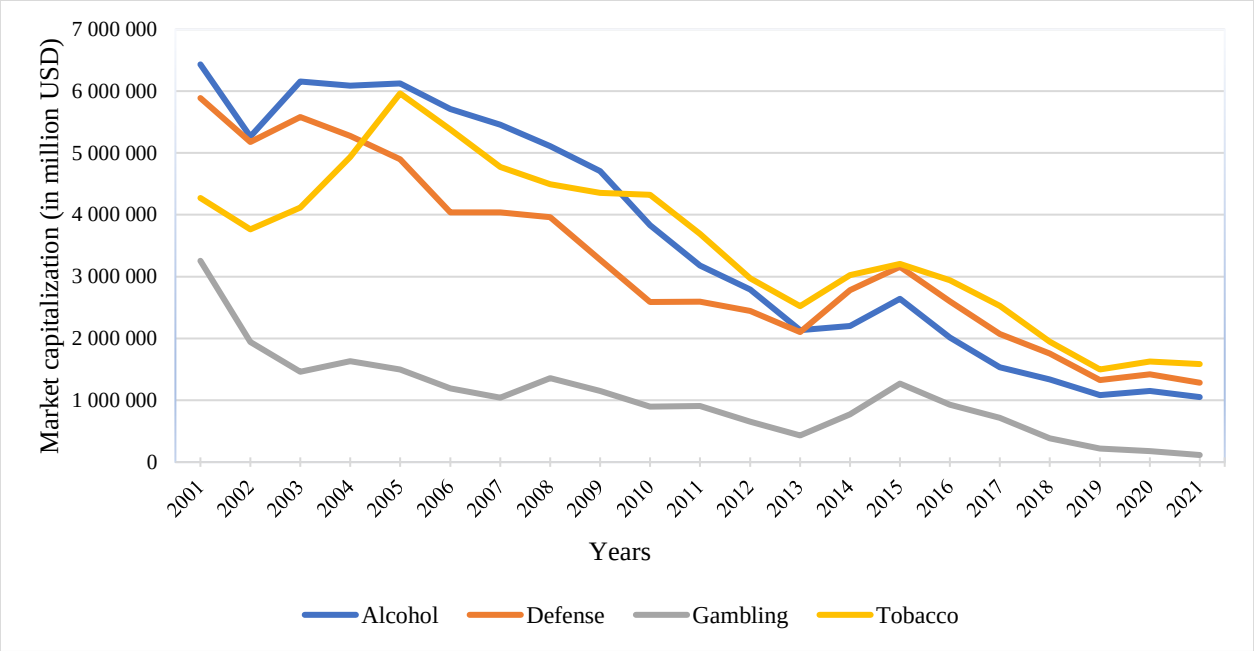


Figure 4.1 Yearly market capitalization in the sample by industry

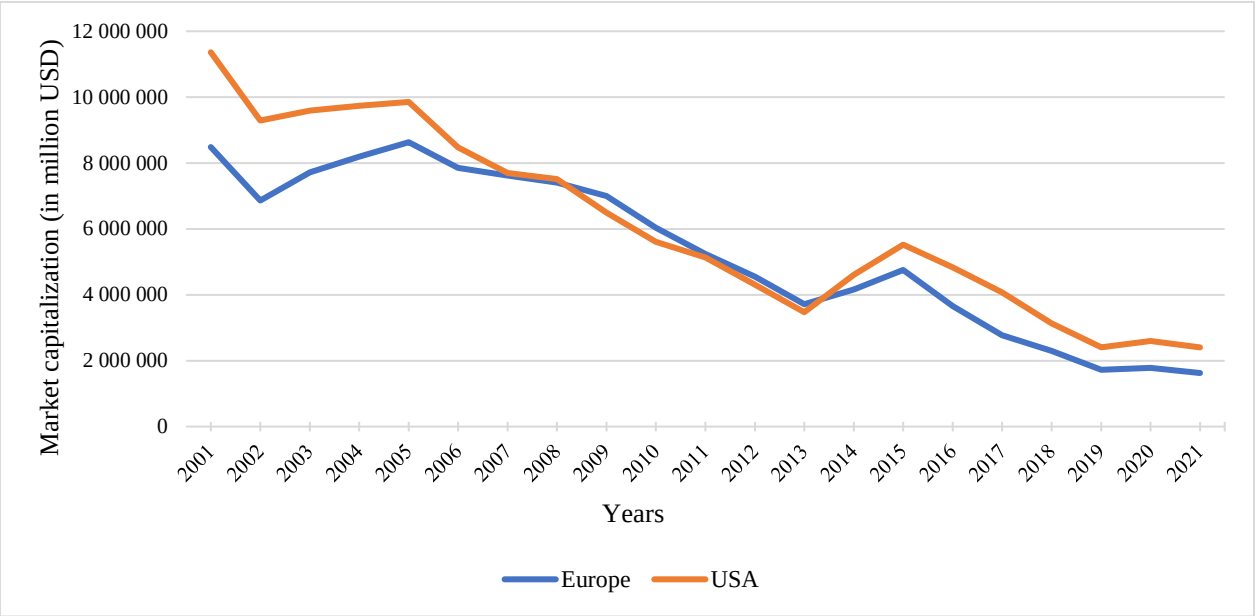


Figure 4.2 Yearly market capitalization in the sample by continent

4.1.1 Portfolio construction

Nine sin portfolios are constructed: a sin portfolio including the whole sample; four industry portfolios where sin stocks are sorted by their industry; a sin portfolio only including firms in the USA; a sin portfolio only including firms in Europe; two time period portfolios where the initial time period was divided in two. All portfolios are value-weighted and re-weighted monthly.

4.2 ESG data

The ESG data used is from Refinitiv, which offers one of the most comprehensive ESG databases covering more than 70 % of the global market cap (Refinitiv, 2022). The ESG score reflects the ESG performance, commitment, and effectiveness based on publicly reported information. The ESG score is a relative sum of 10 category scores that belong to one of the three pillars: environmental, social, and corporate governance.[8] The category weights will vary based on the industry for the environmental and social pillars. The scores are normalized and range between 0

[8] Categories in the environmental pillar: resource use, emissions, and innovation. Categories in the social pillar: workforce, human rights, community, and product responsibility. Categories in the governance pillar: management, shareholders, and CSR strategy (Refinitiv, 2021, p. 3).

and 100, where the higher the score the better. The scores in an industry are sorted into four percentiles and graded as presented in Table 4.4 (Refinitiv, 2022).

The ESG data is downloaded from Thomson Reuters Eikon and includes the ESG score, the environmental pillar score, the social pillar score, and the governance pillar score. The data is available as annual time series data, and the time span is from 2011 – 2021. ESG data is available for 95 sin stocks. There are different types of ESG scores, the one used in this thesis is labelled as *The ESG Combined score* and is adjusted for controversies based on negative ESG events in the media.[9] Thus, this score will usually be lower than ESG scores without this adjustment. It was decided to use an ESG score with this adjustment as it includes more information that just the reported data the firms provide themselves and therefore it may give a more accurate picture of how investors view the ESG characteristics of the firm.

Table 4.4 Score range and grade description

Score range	Description
00 <= score <= 25	Grade D. Poor relative ESG performance. Insufficient degree of transparency in reporting ESG data publicly
25 < score <= 50	Grade C. Satisfactory relative ESG performance. Moderate degree of transparency in reporting ESG data publicly
50 < score <= 75	Grade B. Good relative ESG performance. Above-average degree of transparency in reporting ESG data publicly
75 < score <= 100	Grade A. Excellent relative ESG performance. High degree of transparency in reporting ESG data publicly

This table is based on the grading system found in Environmental, Social, and Governance Scores from Refinitiv (2022, p. 7).

Table 4.5 Descriptive statistics of ESG scores in the sample

Score	Mean	Min	Max
ESG score	40.58	7.15	77.67
Environmental pillar score	38.33	2.70	88.05
Social pillar score	43.49	6.79	87.78
Governance pillar score	46.50	3.32	84.64

The table presents descriptive statistics of the ESG scores of the 95 sin stocks in the sample.

[9] The score is adjusted for the bias that larger firms attract more media attention than smaller firms.

Table 4.5 show that on average, the sample has the highest score in the governance pillar. All pillar averages indicate a grade of C, which indicates satisfactory ESG performance according to the Refinitiv (2022) grading system presented in Table 4.4. Figure 4.3 shows that the scores in the sample are skewed to the left, with few firms that would earn a grade A (an ESG score of 75 or higher). However, the scores are not clustered in a way that hinder sensible portfolio construction: as will be presented in Section 4.2.1, firms with scores in the middle third are not included, ensuring large differences in scores between the portfolios constructed. However, one should be aware that there is an underrepresentation of firms with grade A ESG scores in the sample.

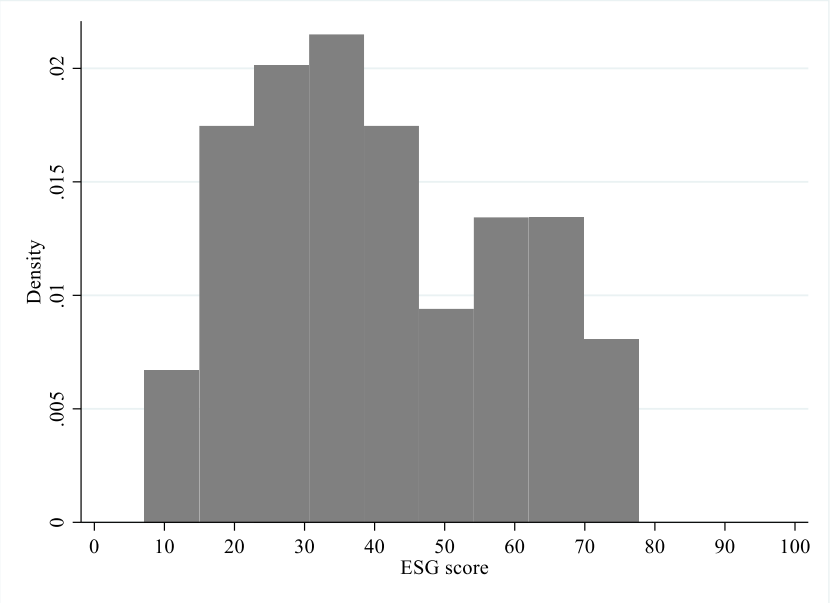


Figure 4.3 Histogram of ESG scores in the sample

4.2.1 ESG portfolio construction

ESG scores from 2011 – 2021 for the 95 firms are averaged and sorted from highest to lowest. The bottom third constitutes the low-ESG portfolio; the middle third constitutes the medium-ESG portfolio; the top third constitutes the high-ESG portfolio. It is only the low-ESG and high-ESG-portfolios that will be reported in this thesis, as these are relevant to the hypotheses. A zero-net investment portfolio is created by going long the low-ESG portfolio and short the high-ESG portfolio. The same portfolio construction approaches are conducted for portfolios based on the

environmental pillar score, the social pillar score, and the governance pillar score. All portfolios are value-weighted and re-weighted monthly.

Table 4.6 Descriptive statistics of ESG portfolios by industry

	Total ESG sample		Low-ESG portfolio		High-ESG portfolio	
Industry	Mean	Freq.	Mean	Freq.	Mean	Freq.
Alcohol	44.40	22	18.47	4	64.07	8
Defense	42.04	32	23.49	9	61.54	11
Gambling	32.14	30	19.31	16	57.92	6
Tobacco	51.71	11	23.94	3	64.97	7
Total	40.58	95	20.81	32	62.24	32

Frequency denote number of firms in each industry.

The low-ESG portfolio's average equals a grade D in the Refinitiv grade system and the high-ESG portfolio's mean equals a grade B. The low-ESG portfolio has an overweight of firms in the gambling industry, which have the lowest means compared to the other industries. The defense firms are spread throughout the three portfolios, whilst the tobacco firms have an overweight in the high-ESG portfolio. Table 4.7 shows that American sin firms have noticeably lower ESG scores compared to European sin firms, and thus are overweighted in the low-ESG portfolio.

Table 4.7 Descriptive statistics of ESG portfolios by continent

	Total ESG sample		Low-ESG portfolio		Low-ESG portfolio	
Continent	Mean	Freq.	Mean	Freq.	Mean	Freq.
Europe	48.53	42	17.57	5	64.85	19
USA	34.27	53	21.42	27	58.43	13
Total	40.58	95	20.81	32	62.24	32

Frequency denote number of firms in each continent.

5 Methodology

For the return analysis, time-series regressions of the sin stock portfolio's monthly returns net the risk-free rate are conducted. The same approach is conducted for the return analysis on the sin stock ESG portfolios, as well as applying a zero-net investment strategy going long sin stocks with low ESG scores and short sin stocks with high ESG scores. Following Blitz and Fabozzi (2017), the CAPM, the Carhart model and the Fama-French three- and five factor models are applied, with combinations of the Momentum factor and the Betting-Against-Beta factor.

5.1 The Capital Asset Pricing Model and Jensen's alpha

The CAPM was developed almost simultaneously by Sharpe (1963, 1964) and Treynor (1961), and further developed by Mossin (1966), Lintner (1965, 1969), and Black (1972). The equilibrium pricing model shows that the equilibrium rates of return on all risky assets are a function of their covariance with the market. Investors can minimize idiosyncratic risk through diversification and be left with the systematic risk which is the covariance of the asset with the market. Thus, the only risk that investors are willing to pay a premium for is covariance risk i.e., the systematic risk which is measured by the beta.[10] The return of the risky asset is a linear function of its systematic risk:

$$R_{i,t} = R_{f,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \epsilon_t \quad (5.1)$$

where:

$R_{i,t}$ *= Return of portfolio i at time t*

$R_{f,t}$ *= The risk-free rate at time t*

$R_{m,t} - R_{f,t}$ *= Market risk premium*

β_{mrkt} *= Exposure to market risk premium*

ϵ_t *= Error term at time t*

Based on the CAPM, Jensen (1968) derived a risk-adjusted measure of portfolio performance known as «Jensen's Alpha» (hereby alpha). It represents the abnormal return or the pricing error of a security or a portfolio over the expected return derived by the CAPM. If the CAPM holds the alpha will be zero. If the alpha is positive (negative) the asset has earned higher (lower) returns

[10] The quantity of risk, called beta, is the covariance between the return of the risky asset and market portfolio, divided by the variance of the market portfolio.

than what is suggested from its amount of systematic risk. The relationship can be formulated like this:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \epsilon_t \quad (5.2)$$

where:

$\alpha_{i,t}$ = Jensen's Alpha, i.e., the intercept/abnormal return of portfolio i at time t

Even though the CAPM is fundamental in financial theory, it has somewhat struggled empirically. Tests on the risk premium show that the positive relation between beta and average return is too flat. The implication of this is that low-beta (high-beta) securities earn more (less) than the CAPM would predict. These findings have been widely documented: Copeland, Weston, and Shastri (2005), and Fama and French (2004) provide great summaries of empirical evidence for and against the CAPM. Even though the CAPM has faced empirical drawbacks Copeland et al. (2005, p. 186) argue that the main implications of the model are upheld: systematic risk is a valid measure of risk, and the relationship between return and risk is positive.

5.2 The Fama-French three-factor model

The Fama and French (1992) three-factor model has become a dominating model in empirical research of security returns. The multifactor model is based on The Arbitrage Pricing Theory of Ross (1976). The systematic factors in the model are the market factor, size factor (measured by market capitalization), and value factor (measured by book-to-market ratio). The justification was rooted on well-documented empirical grounds: the historical-average returns on small stocks and value stocks are higher than the CAPM predicts. Thus, the size and value factors are proxies for systematic risk related to the size and value of the firm rewarding investors with higher returns (Fama & French, 1993). The SMB (Small Minus Big) factor is the return of a diversified value-weighted portfolio long in small firms and short in large firms. The HML (High Minus Low) factor is the return of a diversified value-weighted portfolio long in firms with high book-to-market ratios (i.e., value firms) and short in firms with low book-to-market ratios (i.e., growth firms). The Fama-French three-factor model is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \epsilon_t \quad (5.3)$$

where:

SMB_t = Size factor at time t (Small Minus Big)

β_{SMB} = Exposure to the size factor

HML_t = Value factor at time t (High Minus Low)

β_{HML} = Exposure to the value factor

5.3 The Carhart four-factor model

The Carhart (1997) four-factor model is an extension of the Fama-French three-factor model that adds a Momentum factor. When studying the performance of mutual funds Carhart (1997) find that the momentum effect explained why some funds performed better than others: the funds that performed best did so because they by chance held larger proportions of previous winning stocks. The four-factor model has become a common model used to evaluate portfolio returns (Bodie, Kane & Markus, 2021). The Momentum factor is called WML (Winners Minus Losers) and is a diversified zero-net investment portfolio long a high prior return portfolio and short a low prior return portfolio. The Carhart four-factor model is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{WML} * WML_t + \epsilon_t \quad (5.4)$$

where:

WML_t = Momentum factor at time t (Winners Minus Losers)

β_{WML} = Exposure to the Momentum factor

5.4 The Fama-French five-factor model

Fama and French (2015) extend the original three-factor model by including two new factors capturing profitability and investment patterns in average stock returns. The profitability factor accounts for the pattern that profitable firms perform better than unprofitable firms. The profitability factor is RMW (Robust Minus Weak) and is the return of a diversified value-weighted portfolio going long in firms with robust profitability and short in firms with weak profitability. The investment factor accounts for the pattern that the stocks with high asset growth have below-average returns. CMA (Conservative Minus Aggressive) is the return of a diversified value-weighted portfolio going long in firms with a conservative investment profile and short in firms with aggressive investment profiles. The Fama-French five-factor model is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{RMW} * RMW_t + \beta_{CMA} * CMA_t + \epsilon_t \quad (5.5)$$

where:

RMW_t = Profitability factor at time t (Robust Minus Weak)

β_{RMW} = Exposure to the profitability factor

CMA_t = Investment factor at time t (Conservative Minus Aggressive)

β_{CMA} = Exposure to the investment factor

In addition, the Momentum factor presented in Chapter 5.3 will be added to the five-factor model, which is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{RMW} * RMW_t + \beta_{CMA} * CMA_t + \beta_{WML} * WML_t + \epsilon_t \quad (5.6)$$

5.5 Betting-Against-Beta Factor

Frazzini & Pedersen (2014) presents the Betting-Against-Beta (BAB) factor. The rationale is that many investors (such as pension funds and mutual funds) have constraints in the leverage they can take on, and instead overweight their portfolios in risky securities to achieve higher expected returns. This goes against the basic premise of the CAPM where investors leverage or de-leverage their portfolio by their risk preference. As mentioned in section 5.1, there is evidence that low-beta (high-beta) assets earn more (less) than the CAPM would predict. Frazzini and Pedersen (2014) show how this deviation from the CAPM can be captured by using the BAB factor, thus being a useful control variable in asset pricing regressions. The BAB factor is the return of a self-financing portfolio long a low-beta portfolio and short a high-beta portfolio. The BAB factor will be added to the three-factor and five-factor models. The Fama-French three-factor model with Betting-Against-Beta is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{BAB} * BAB_t + \epsilon_t \quad (5.7)$$

where:

BAB_t = Betting-Against-Beta factor at time t

β_{BAB} = Exposure to the Betting-Against-Beta factor

The Fama-French five-factor model with Betting-Against-Beta is structured as follows:

$$R_{i,t} - R_{f,t} = \alpha_{i,t} + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{RMW} * RMW_t + \beta_{CMA} * CMA_t + \beta_{BAB} * BAB_t + \epsilon_t \quad (5.8)$$

5.6 Robustness

The econometric method used in this study is the Ordinary Least Squares (OLS) method. The Gauss-Markov Theorem requires five assumptions to be met for the OLS to be the best linear unbiased estimator*: I) Linearity in parameters; II) No serial correlation; III) No perfect collinearity; IV) Zero conditional mean; V) Homoskedasticity* (Wooldridge, 2012). Since the models applied are well established in academia, it is fair to assume that they are correctly specified. The models are linear in their parameters, and assumption I) is met. The residuals are approximately normal and assumption *IV) Zero conditional mean* is met: the portfolio- and residual analysis confirming this is found in Appendix C. The rest of the assumptions will be tested in the remainder of this chapter.

5.6.1 Serial correlation and heteroskedasticity

Serial correlation is when the error term is a function of its previous value. Heteroskedasticity is when the variance of the error term is not constant. Serial correlation and heteroskedasticity do not cause bias in the coefficient estimates, but it affects the minimum-variance property of OLS. This leads to an increased chance of rejecting the null hypothesis, meaning that the hypothesis testing becomes unreliable (Studenmund, 2017). To test for serial correlation, the Breusch-Godfrey test is conducted. To test for heteroskedasticity, the Breusch-Pagan test is conducted.

Table 5.1 Tests for serial correlation and heteroskedasticity

	Breusch Godfrey	**Breusch–Pagan**		**Breusch Godfrey**	**Breusch–Pagan**
CAPM			*Fama-French five-factor*		
Total Sin	0.411	2.210	Total Sin	0.505	4.260
High-ESG	0.006	0.070	High-ESG	0.019	**10.120***
Low-ESG	0.028	1.260	Low-ESG	**3.053***	**14.310*****
Fama-French three-factor			*Fama-French five-factor with Momentum*		
Total Sin	0.312	3.950	Total Sin	0.612	5.280
High-ESG	0.040	5.130	High-ESG	0.002	9.730
Low-ESG	2.909	**12.060*****	Low-ESG	**2.967***	**15.360****
Carhart four-factor			*Fama-French five-factor with Betting-Against-Beta*		
Total Sin	0.064	4.510	Total Sin	0.568	6.970
High-ESG	0.077	6.480	High-ESG	0.019	**12.290***
Low-ESG	**2.854***	**13.450*****	Low-ESG	**3.376***	**14.270****
Fama-French three-factor with Betting-Against-Beta					
Total Sin	0.201	4.940			
High-ESG	0.033	5.060			
Low-ESG	**3.186***	**11.830****			

*The table reports the Chi-Square test statistics for the Breusch-Godfrey and Breusch-Pagan tests. The null hypothesis for the Breusch-Godfrey is no serial correlation. The null hypothesis for the Breusch-Pagan tests is homoskedasticity. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance.*

The total sin portfolio does not have any instances of rejection of the null hypothesis for either of the tests. Thus, it is fair to conclude that assumptions *II) No serial correlation* and *V) Homoskedasticity* are met. However, the same cannot be claimed for the ESG portfolios. The Breusch-Godfrey test indicates serial correlation for the low-ESG portfolio in most of the models. The null hypothesis for the Breusch-Pagan is rejected with a 1 % and 5 % significance level for the low-ESG portfolio and thus indicating heteroskedasticity. It is important to have in mind that the ESG portfolios have smaller samples than the total sin portfolio, which may be a possible explanation. Assumptions *II)* and *V)* do not seem fulfilled for the low-ESG portfolio.

A remedy for serial correlation and heteroskedasticity is Newey-West standard errors (Newey & West, 1987). The Newey-West standard errors do not change the coefficients from the OLS but correct the standard errors for heteroskedasticity and serial correlation. Typically, these standard errors will be larger than the standard errors produced by OLS, resulting in lower t-scores, and increasing the p-value (Studenmund, 2017, p. 314). In this thesis, Newey-West standard errors are used in all regressions on the ESG-portfolios.

5.6.2 Multicollinearity

Multicollinearity is a linear relationship between independent variables that is of such magnitude that it can significantly affect the coefficients of the variables (Studenmund, 2017, p. 242). Whilst severe imperfect multicollinearity will not violate assumption *III)*, it can still cause problems as OLS will struggle to separate the effects of one explanatory variable from another.

Table 5.2 The Pearson correlation coefficients

	Mrkt-Rf	SMB	HML	RMW	CMA	MOM	BAB
Mrkt-Rf	1.0000						
SMB	0.0700	1.0000					
HML	-0.0182	0.2448	1.0000				
RMW	-0.3700	-0.1363	-0.1332	1.0000			
CMA	-0.3637	0.0426	0.6615	0.0703	1.0000		
MOM	-0.4426	0.0319	-0.0748	0.4494	0.2655	1.0000	
BAB	-0.1918	0.2923	0.2538	0.4195	0.2362	0.5513	1.0000

The table presents the Pearson correlation coefficients. The coefficients have a value between -1 and 1: -1 is a perfect negative linear correlation; 0 is no correlation; +1 is a perfect positive correlation. The Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.

Table 5.2. show the Pearson correlation coefficients between the explanatory variables used in this thesis. There is no blueprint as to what correlation coefficient in absolute values is interpreted as "too high": a common rule of thumb is that a coefficient around |0.7| or |0.8| indicates a strong linear relationship that could potentially affect the statistical power of regression models (Nettleton, 2014; Studenmund, 2017). In absolute values the highest correlation coefficient is between the CMA and HML factors of 0.6615, indicating a moderate to strong positive linear relationship. This is a well-known correlation in line with the literature of Fama and French (2015): value firms often have conservative investment profiles, whilst growth firms often have aggressive investment styles. The Momentum and Betting-Against-Beta factors have a correlation coefficient of 0.5513, indicating a moderate positive linear relationship. Besides the correlation between the CMA and HML factors, the correlation coefficients do not indicate any strong linear relationships that could weaken the statistical power of the regression models.

However, Studenmund (2017) warns that a low correlation coefficient does not mean that one can disregard the possibility of severe multicollinearity. Hence, the use of multiple detection methods is encouraged. The Variance Inflation Factor (VIF) is a method used to detect severe

multicollinearity. It looks at how one explanatory variable can be explained by the other explanatory variables. There is no determined critical value for the VIF values, but a common rule of thumb is that VIF values above 5 can indicate severe multicollinearity (Studenmund, 2017, p. 252). All the VIF values in Table 5.3 are well below this. Based on the correlation matrix and VIF table, it is concluded that assumption *III) No perfect multicollinearity*, is met. Furthermore, it is confirmed that there are no problems with severe multicollinearity in my sample. This is expected, as the Fama-French factors are very recognized in asset pricing research.

Table 5.3 The Variance Inflation Factor (VIF)

	VIF	1/VIF
Mrkt-Rf	1.43	0.70
SMB	1.10	0.91
HML	2.17	0.46
RMW	1.20	0.84
CMA	2.33	0.43
Mean VIF	1.64	

The table presents the Variance Inflation Factor (VIF) and the inverse VIF (1/VIF). VIF values above 5 can indicate severe multicollinearity. Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.

6 Results

6.1 The sin portfolio

The regressions in this chapter test *Hypothesis 1: sin stocks earn abnormal returns*. Multiple time-series regressions are run with different variations of the sin portfolio: the total sin portfolio containing all sin stocks in the defined investment universe; the sin portfolio by continent; the sin portfolio by each time period; the sin portfolio by industry. The dependent variable is the portfolio's monthly returns net the risk-free rate. The coefficient of interest is the alpha, which expresses monthly excess returns.

6.1.1 The total sin portfolio

Table 6.1 Regression results for the total sin portfolio's monthly returns net risk-free rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0080*** **	**0.0078*** **	**0.0069*** **	**0.0061*** **	**0.0033***	**0.0033***	**0.0035** **
	(4.5463)	(4.5034)	(3.9717)	(3.3294)	(1.9452)	(1.9565)	(2.0284)
Mrkt-Rf	**0.7029*** **	**0.7106*** **	**0.7572*** **	**0.7340*** **	**0.8470*** **	**0.8429*** **	**0.8466*** **
	(18.1259)	(18.5780)	(17.8701)	(18.9592)	(20.4651)	(19.8899)	(20.4260)
SMB		-0.1339	-0.1496	**-0.2002***	0.0240	0.0325	0.0465
		(-1.2668)	(-1.4266)	(-1.8687)	(0.2435)	(0.3237)	(0.4431)
HML		**0.2469*** **	**0.2642*** **	**0.1950** **	0.1431	0.1303	0.1546
		(3.3291)	(3.5811)	(2.5780)	(1.4401)	(1.2637)	(1.5284)
WML			**0.1238** **			-0.0245	
			(2.4513)			(-0.4700)	
BAB				**0.1725*** **			-0.0423
				(2.7385)			(-0.6298)
RMW					**0.8374*** **	**0.8589*** **	**0.8797*** **
					(6.8636)	(6.5822)	(6.3123)
CMA					**0.3419** **	**0.3620** **	**0.3448** **
					(2.4578)	(2.4837)	(2.4742)
R^2	0.5679	0.5883	0.5981	0.6004	0.6612	0.6615	0.6617
Adjusted R^2	0.5662	0.5833	0.5916	0.5940	0.6543	0.6532	0.6534
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on a value-weighted portfolio of sin stocks net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with betting-against-beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

The alpha is significant at the 1 % level in the CAPM (1), three-factor model (2), the Carhart-model (3), and when introducing the Betting-Against-Beta factor (4). The three-factor model (2) suggests that the sin portfolio has average abnormal monthly returns of 0.0078 (or 0.78 %). In these models, the HML coefficient is significant and positive, indicating that sin stocks are value stocks, which are typically stocks with steady cash flows, and limited growth possibilities. The Momentum coefficient in (3) indicates that the portfolio's returns can be explained by a positive momentum effect in the stock market. The market factor in (1), interpreted as the CAPM beta, is only 0.7029. The positive and significant BAB coefficient in (4) indicates that the abnormal returns of the sin stock portfolio may be due to the low-beta characteristics of the portfolio. This suggests that the sin stock portfolio has less systematic risk than the market and that the low-beta characteristic contributes to abnormal returns.

The significance of the alpha is reduced to 10 % in the five-factor model (5). When the profitability factor (RMW) and the investment factor (CMA) are introduced, neither SMB, HML, WML nor BAB are significant. An important note is the empirically known correlation between the CMA and HML factors discussed in Chapter 5.6.2: value firms often have conservative spending profiles, whilst growth firms often can be capital intensive. In this sample the correlation between the two is 0.6615, for the full correlation matrix please see Table 5.2. When the CMA factor is introduced, the HML is no longer significant. Given the positive correlation, the value factor seems to have absorbed some of the effect of the CMA factor. Thus, it seems that in this portfolio it is not the value effect of the sin stocks that is driving their returns, but their conservative investment profile.

When the Betting-Against-Beta factor is included in addition to the five-factor model (7) the T-score of the alpha increases somewhat, increasing its significance. Neither the MOM nor BAB coefficients are significant when introduced as variations to the five-factor model. The adjusted R^2 remains almost constant, and the coefficients of the other explanatory variables barely change. The coefficient of the alpha does not change when including the Momentum factor and only barely increases with the BAB factor. Overall, these variations of the five-factor model do not seem to be contributing to any explanatory power, and the total sin stock portfolio is best explained by the five-factor model (5) with an adjusted R^2 at 0.6543. The five-factor model (5) suggests that the sin portfolio has average abnormal monthly returns of 0.0033 (or 0.33 %), which is 4.03 % in annualized returns. The alpha remains positive, but with varying significance throughout the

regression models. The regression results are in favor of *Hypothesis 1*, indicating that the sin stock portfolio has earned excess returns in this period of time. However, this finding is only significant at the 10 % level in the model with the highest explanatory power (5).

6.1.2 Sin portfolio by continent

To further test *Hypothesis 1*, time-series regressions are run on the sin portfolio split by continent: one portfolio for stocks in the USA and one portfolio for stocks in the selected countries in Europe. Table 6.2 provides the results of the five-factor model as this was the model with the highest explanatory power for both continents. For full regression tables with all models per continent see Appendix D.

Table 6.2 Regression results for the monthly returns net risk-free rate of sin portfolios by continent

	USA	Europe
Alpha	**0.0036***	0.0027
	(1.8386)	(1.2399)
Mrkt-Rf	**0.9870*****	**0.6979*****
	(20.6305)	(13.1688)
SMB	0.0222	0.0019
	(0.1948)	(0.0151)
HML	**0.2196***	0.0709
	(1.9125)	(0.5574)
RMW	**0.7709*****	**0.9026*****
	(5.4660)	(5.7777)
CMA	**0.4033****	0.2733
	(2.5077)	(1.5344)
R^2	0.6703	0.4438
Adjusted R^2	0.6636	0.4325
Observations	252	252

*The table reports the Fama-French five-factor model on the sin portfolio in the USA and Europe. The portfolios are value-weighted, and time-series regressions are run on the monthly return net risk-free rate over the period January 2001 - December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.*

The alpha is significant for the USA portfolio, however only at the 10 % level. In Europe, there is no indication of abnormal returns. The size factor is not significant in either portfolio, and the value factor is only significant at the 10 % level for the USA portfolio, indicating a tilt towards value firms. The profitability factor is highly significant for both continents, indicating that the returns

are driven by the high profitability of the sin stocks, which is in line with the findings for the total sin portfolio in Table 6.1. The investment factor, which was significant for the total sin portfolio, is only significant in the USA. This indicates that the investment style of the sin stocks is only important in explaining the returns of the USA sin stock portfolio. The USA portfolio has a noticeably higher adjusted R^2 at 0.6636 compared to 0.4325 for Europe. The regression results give contradictory results regarding *Hypothesis 1*. In Europe, there seems to be no evidence for abnormal returns, whilst there are slightly significant abnormal returns in the USA portfolio.

6.1.3 Sin portfolio by time period

To further test *Hypothesis 1*, the original sample is divided into two time periods. Table 6.3 provides the results of the time-series regressions of the five-factor model, as neither the Momentum nor the Betting-Against-Beta factor was significant explanatory variables. For full regression tables with all models for each time period please see Appendix E.

Table 6.3 Regression results for the monthly returns net risk-free rate of sin portfolios by time period

	First time period *Jan. 2001 – June 2011*	Second time period *July 2011 – Dec. 2021*
Alpha	**0.0053****	0.0010
	(2.0600)	(0.4565)
Mrkt-Rf	**0.7661*****	**0.9212*****
	(12.0146)	(16.5630)
SMB	0.0780	-0.1618
	(0.5851)	(-1.0135)
HML	**0.3288****	-0.0869
	(2.1263)	(-0.5576)
RMW	**0.6733*****	**0.6820*****
	(3.6959)	(3.3177)
CMA	0.1367	**0.6245****
	(0.7598)	(2.3948)
R^2	0.6361	0.7087
Adjusted R^2	0.6210	0.6966
Observations	126	126

*The table reports the Fama-French five-factor model for two portfolios representing the first and second time period in the original sample. Each time period represents 126 months. The portfolios are value-weighted, and time-series regressions are run on the monthly return net risk-free rate. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.*

There are some differences when comparing the regression results of the two time periods. First, the alpha is significant for the first time period at a 5 % level but seems to have disappeared completely during the second time period. The profitability factor is highly significant and positive for both portfolios, but the portfolios differ as to whether the returns are explained by the value or the investment factor. In the second time period the returns are explained by the profitability of the firms and the conservative investment strategies. This is in line with the previous regression results on the total sin portfolio in Table 6.1, except that there are no longer any abnormal returns. For the first time period the value factor is significant while the investment factor, which is in line with the US sin portfolio regression results presented in Table 6.2. It seems as if the abnormal return for the total sin portfolio in Table 6.1 is driven by the first time period. Dividing the original sample into two time periods gives contradictory results regarding *Hypothesis 1*, as the returns are fully

explained in the second time period. The results show that there have been no abnormal returns for sin stocks in the sample from July 2011 – December 2021.

6.1.4 Sin portfolio by industry

To further test *Hypothesis 1*, the original sin stock sample is divided into industry portfolios: alcohol, defense, gambling, and tobacco. Table 6.4 provides the results of the time-series regressions for the five-factor model. Neither the WML nor BAB factors was significant explanatory variables for the industry portfolios after including RMW and CMA[11], they have been therefore disregarded here. However, full regression tables with all models per industry are found in Appendix F.

Table 6.4 Regression results for monthly returns net risk-free rate for sin portfolios by industry

	Alcohol	Defense	Gambling	Tobacco
Alpha	0.0016	**0.0039***	**0.0085***	0.0013
	(0.6641)	(1.8843)	(1.8442)	(0.3945)
Mrkt-Rf	**0.7110*****	**0.8950*****	**1.4711*****	**0.7766*****
	(12.0280)	(17.7267)	(13.0614)	(9.9585)
SMB	-0.0050	-0.0239	**1.0771*****	-0.1885
	(-0.0358)	(-0.1993)	(4.0197)	(-1.0163)
HML	0.1388	**0.2156***	**0.6839****	-0.0026
	(0.9780)	(1.7788)	(2.5296)	(-0.0137)
RMW	**1.0444*****	**0.3721****	**1.0705*****	**1.0522*****
	(5.9929)	(2.5003)	(3.2240)	(4.5769)
CMA	0.1122	**0.2853***	-0.6023	**0.7842*****
	(0.5645)	(1.6813)	(-1.5909)	(2.9920)
R^2	0.4128	0.6149	0.5268	0.3042
Adjusted R^2	0.4009	0.6071	0.5172	0.2901
Observations	252	252	252	252

*The table reports the Fama-French five-factor model for four portfolios representing each sin industry. Time-series regressions of monthly returns on the value-weighted portfolio's net risk-free rate are run over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.*

[11] Except for the Gambling-portfolio, where both the Momentum and the BAB were significant with negative coefficients after controlling for RMW and CMA. Please see Appendix F for full regression tables.

The alphas are only significant at the 10 % level for the defense and gambling industries. There are no abnormal returns for the alcohol and tobacco industries. The explanatory powers of the models are varying: the defense and gambling portfolio has adjusted R^2 of 0.6071 and 0.5172, whilst the tobacco portfolio has the lowest explanatory power with an adjusted R^2 of only 0.2901. The only factor that is significant for all the industries, in addition to the market, is the profitability factor. It remains highly significant at 5 % level or lower, indicating that all the industries are enjoying profitable operations. Neither the SMB, HML, nor CMA is robust in explaining the returns across industries. It is only the tobacco industry that has a highly significant investment factor, indicating a conservative investment profile in the industry. As some industries have abnormal returns with significance at the 10 % level, the regression results are not united regarding *Hypothesis 1*.

6.2 The sin and ESG-portfolio

This section tests *Hypothesis 2: sin stocks with low ESG scores have abnormal returns; Hypothesis 3: sin stocks with high ESG scores have no abnormal returns; Hypothesis 4: sin stocks with low ESG scores have outperformed sin stocks with high ESG scores.* To test *Hypothesis 2* and *3*, regressions are run on portfolios determined by their ESG scores, environmental pillar score, social pillar score, and governance pillar score. The same portfolios are used to create zero-net portfolios testing *Hypothesis 4.* The coefficient of interest is the alpha, which expresses the monthly excess returns of the portfolio.

6.2.1 Sin portfolio by ESG score

Table 6.5 shows regression results for the low-ESG and high-ESG portfolios. The five-factor model is chosen to be presented, due to the overall highest explanatory power. Full regression tables with all models for each portfolio are in presented Appendix G. The dependent variable is the portfolio's monthly returns net the risk-free rate.

Table 6.5 Regression results for the monthly returns net risk-free rate for sin portfolios by ESG score

	low-ESG	high-ESG
Alpha	**0.0163*** **	-0.0011
	(2.9796)	(-0.5651)
Mrkt-Rf	**1.2875*** **	**0.9199*** **
	(6.6887)	(15.7643)
SMB	**2.1843*** **	**-0.3754** **
	(3.4190)	(-2.4864)
HML	**-0.6446***	-0.0920
	(-1.7203)	(-0.6632)
RMW	0.3522	**0.5537** **
	(0.4949)	(2.2733)
CMA	-0.4487	**0.8063*** **
	(-0.6742)	(3.9376)
R^2	0.5139	0.7061
Adjusted R^2	0.4925	0.6932
Observations	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with ESG scores are ranked from top to bottom by their average ESG score. The firms in the bottom third constitute the Low-ESG portfolio and the firms in the top third constitute the High-ESG portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.*

The low-ESG portfolio is the only portfolio with significant alpha: The low-ESG portfolio has average abnormal monthly returns of 0.0163 (or 1.63 %), which is 21.41 % in annualized returns. The size effect has a high positive significant coefficient, indicating that the firms in the low-ESG portfolio are of smaller size. The value factor is significant at a 10 % level with a negative coefficient, suggesting that the portfolio is predominantly growth stocks. Noticeably, neither the profitability factor nor the investment factor is significant for the low-ESG portfolio. The regression result supports *Hypothesis 2* as the low-ESG portfolio has had abnormal returns in the period.

The high-ESG portfolio does not have a significant alpha. The portfolio has a negative significant coefficient on the size factor, indicating that the firms in this portfolio are larger companies. Furthermore, the RMW and the CMA are positive and significant indicating that the firms in this

portfolio have robust earnings and conservative investment profiles. The regression result supports *Hypothesis 3* as the high-ESG portfolio has not had abnormal returns in the period.

6.2.2 Sin portfolio by pillar score

Table 6.6 shows regression results for the low and high environmental (E.), social (S.) and governance (G.) portfolios. The five-factor model is presented, but full regression tables with all models for each portfolio are available in Appendix H. The dependent variable is the portfolio's monthly returns net the risk-free rate.

Table 6.6 Regression results for the monthly returns net risk-free rate for sin portfolios by pillar score

	low E.	high E.	low S.	high S.	low G.	high G.
Alpha	**0.0128*** **	-0.0025	**0.0147*** **	-0.0011	**0.0075** **	-0.0026
	(3.0102)	(-1.1716)	(2.6599)	(-0.5409)	(2.2024)	(-1.1685)
Mrkt-Rf	**1.0974*** **	**0.9533*** **	**1.2353*** **	**0.8776*** **	**1.0778*** **	**0.9724*** **
	(7.7661)	(14.2952)	(6.3608)	(13.8146)	(8.3535)	(14.2737)
SMB	**1.4818*** **	**-0.3607** **	**1.9630*** **	**-0.4354*** **	**0.9476*** **	**-0.3651** **
	(2.8431)	(-2.1960)	(3.0332)	(-2.7611)	(2.7337)	(-2.2123)
HML	-0.3850	-0.1529	**-0.7238** **	-0.1200	-0.1096	-0.1356
	(-1.3784)	(-1.0727)	(-1.9840)	(-0.8423)	(-0.4810)	(-0.9092)
RMW	0.1999	**0.6318** **	0.1588	**0.6035** **	0.6657	**0.6942** **
	(0.3196)	(2.2571)	(0.2226)	(2.3736)	(1.4356)	(2.3858)
CMA	-0.2740	**0.8626*** **	-0.3724	**0.8647*** **	-0.2602	**0.9460*** **
	(-0.5513)	(3.8791)	(-0.5663)	(4.2096)	(-0.6530)	(4.0765)
R^2	0.5015	0.6798	0.4848	0.6665	0.5820	0.6783
Adjusted R^2	0.4797	0.6658	0.4622	0.6519	0.5637	0.6642
Observations	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with pillar scores are ranked from top to bottom by their pillar scores: the firms in the bottom third constitute the low E./S./G. portfolios and the firms in the top third constitute the high E./S./G. portfolios. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor.*

There are multiple different patterns in the regression results. All the low-portfolios have significant alphas at a 5 % or 1 % significance level. Neither of the high-ESG portfolios have significant alphas. The size factor is positive and significant for all the low-portfolios, whilst it is negative and significant for all the high-portfolios. The regression results in Table 6.6 confirm

many of the findings in Table 6.5: Firms with low pillar scores have positive factor exposure to the size premium; the five-factor model factors RMW and CMA are not significant for any low-portfolio, whilst they are significant and positive for the high-portfolios. As all the low-portfolios have abnormal returns, whilst the high-portfolios do not, the regression results are in favor of both *Hypothesis 2* and *Hypothesis 3.*

6.2.3 Zero-net sin portfolio by ESG score

Table 6.7 shows regression results for the zero-net portfolio. The portfolio is created by going long the sin portfolio with low ESG scores and short the sin portfolio with high ESG scores. The dependent variable is the portfolio's monthly returns.

Table 6.7 Regression results for the monthly returns of a zero-net portfolio long a sin portfolio with low ESG scores and short a sin portfolio with high ESG scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0150****	**0.0168*****	**0.0182*****	**0.0200*****	**0.0174*****	**0.0181*****	**0.0191*****
	(2.2990)	(2.9782)	(3.0250)	(3.3084)	(3.1118)	(3.1117)	(3.1970)
Mrkt-Rf	**0.5573*****	**0.4692*****	**0.4037****	**0.4561*****	**0.3676****	**0.3406****	**0.3689****
	(2.7386)	(2.7411)	(2.5032)	(2.6736)	(2.0788)	(2.0260)	(2.1331)
SMB		**2.7490*****	**2.7443*****	**2.8087*****	**2.5597*****	**2.5714*****	**2.6275*****
		(4.9773)	(4.9544)	(5.1905)	(3.9732)	(3.9554)	(4.2808)
HML		**-0.7040***	**-0.8830****	**-0.7237****	-0.5525	**-0.6955***	**-0.6032***
		(-1.9644)	(-2.1575)	(-2.0402)	(-1.6493)	(-1.6971)	(-1.8273)
WML			-0.2753			-0.1512	
			(-1.2129)			(-0.6646)	
BAB				-0.3477			-0.2140
				(-1.1477)			(-0.6875)
RMW					-0.2016	-0.2001	-0.1520
					(-0.3101)	(-0.3043)	(-0.2420)
CMA					**-1.2550***	**-1.1457***	-1.1452
					(-1.9210)	(-1.7524)	(-1.6020)
R^2	0.0747	0.3756	0.3811	0.3823	0.3859	0.3874	0.3882
Adjusted R^2	0.0668	0.3595	0.3595	0.3608	0.3590	0.3549	0.3557
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on the portfolio over the period January 2011- December 2021 (120 months). The zero-net portfolio is long the low-ESG portfolio and short the high-ESG portfolio. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

The alpha is strongly significant and positive throughout all the models. The five-factor model suggests that the monthly excess returns are 0.0174 (or 1.74 %), meaning that the low-ESG portfolio has outperformed the high-ESG portfolio accordingly. The coefficient of the size factor is positive and highly significant throughout the models, suggesting that the size effect is an important driver for the returns. Additionally, the portfolio has a negative factor exposure to the value premium. Neither the profitability factor nor the investment factor is noteworthy significant. The results from Table 6.7 are strongly in favor of *Hypothesis 4*, as the low-ESG portfolio has had excess return over the high-ESG portfolio in the sample.

6.2.4 Zero-net sin portfolio by pillar score

The zero-net portfolio is created by going long a sin portfolio with low environmental (E.), social (S.), or governance (G.) scores, and short a sin portfolio with a high corresponding pillar score. Table 6.8 presents the regression results with the five-factor model. Full regression tables for each portfolio with all models can be found in Appendix I. The dependent variable is the portfolio's monthly returns.

Table 6.8 Regression results for the monthly returns of zero-net portfolios long a portfolio with low pillar scores and short a portfolio with high pillar scores

	Environmental	Social	Governance
Alpha	**0.0153*** **	**0.0158*** **	**0.0101*** **
	(3.3131)	(2.7431)	(3.0229)
Mrkt-Rf	0.1441	**0.3577** **	0.1054
	(1.1108)	(2.0195)	(1.0197)
SMB	**1.8425*** **	**2.3984*** **	**1.3127*** **
	(3.4388)	(3.6836)	(3.9125)
HML	-0.2321	**-0.6038***	0.0260
	(-0.8902)	(-1.7163)	(0.1346)
RMW	-0.4319	-0.4447	-0.0285
	(-0.7791)	(-0.6713)	(-0.0798)
CMA	**-1.1366** **	**-1.2371***	**-1.2063*** **
	(-2.1986)	(-1.8629)	(-3.2369)
R^2	0.3121	0.3722	0.3478
Adjusted R^2	0.2820	0.3446	0.3192
Observations	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on the portfolio net risk-free rate over the period January 2011- December 2021 (120 months). The zero-net portfolio is long the Low-E./S./G. portfolio and short the High-E./S./G. portfolio. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

The alpha is strongly significant and positive for all three portfolios, meaning that all the low portfolios have outperformed the portfolios with higher respective pillar scores. The portfolio has a positive size premium exposure, which is in line results in Table 6.7. The returns are affected negatively by the significant negative factor exposure to the investment factor. Table 6.8 further confirms the findings in Table 6.7: portfolios with low ESG scores or pillar scores have outperformed portfolios with high respective score types. Overall, the results support *Hypothesis 4*, clearly indicating that sin portfolios with low pillar scores have outperformed the high pillar score portfolios.

7 Discussion

7.1 Evidence and Hypothesis 1

This section discusses the evidence of *Hypothesis 1: sin stocks earn abnormal returns.* A summary of the alphas from the sin portfolio regressions is provided in Table 7.1.

Table 7.1 Summary of alphas from sin portfolio time-series regressions

Portfolio		Model	Alpha
Total sin portfolio	*Table 6.1*	Five-factor model	0.0033*
Sin portfolio by continent: USA	*Table 6.2*	Five-factor model	0.0036*
Sin portfolio by continent: Europe	*Table 6.2*	Five-factor model	0.0027
First time period: Jan. 2001 – June 2011	*Table 6.3*	Five-factor model	0.0053**
Second time period: July 2011 – Dec. 2021	*Table 6.3*	Five-factor model	0.0010
Sin portfolio by industry: Alcohol	*Table 6.4*	Five-factor model	0.0016
Sin portfolio by industry: Defense	*Table 6.4*	Five-factor model	0.0039*
Sin portfolio by industry: Gambling	*Table 6.4*	Five-factor model	0.0085*
Sin portfolio by industry: Tobacco	*Table 6.4*	Five-factor model	0.0013

*The table is a summary of time-series regressions of monthly returns on different value-weighted portfolios. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance.*

7.1.1 Anomalies vary over time

The excess return observed in the first time period completely disappeared in the second time period portfolio. This can indicate that a potential sin stock premium has changed over time. This is not unlikely, as it is empirically known that factor exposures and anomalies can increase or decrease over time. In a review paper on market anomalies and market efficiency, Schwert (2003, p. 968) argues that as an anomaly is gaining attention, practitioners begin exploiting the anomaly, soon weakening it, or causing its disappearance as the research finding is making the market more efficient. As anomalies and factor exposures in the financial markets are not constant, this might explain why the alpha is present in the first time period and not in the second time period in the regression results of this thesis. This might be caused by arbitrageurs strategizing on the initial findings of the sin stock premium in Hong and Kacperczyk (2009) and Fabozzi et al. (2008) or other elements that as of now remain unknown. It can also be caused by changes in the perceptions of what is considered as sinful i.e., that investors no longer consider the industries in this sample to be sinful. However, as discussed in Chapter 2, the industries in this thesis are chosen because they are cross-culturally considered sinful and have been viewed as such for a long period of time.

Therefore, it seems unlikely that investors' perceptions of these industries have changed so drastically that it has caused a potential sin stock premium to disappear in the second time period.

7.1.2 The alpha is not robust

Both Blitz and Fabozzi (2017) and Sagbakken and Zhang (2022) found the alpha to be non-significant when controlling for the profitability and investment factors, whilst the total sin portfolio regression in this thesis shows that the alpha remains slightly significant at a 10 % level in the five-factor model. However, when looking at the continent portfolios there is no significant alpha for Europe. This is in line with the study of Sagbakken and Zhang (2022) who found no indications of a sin stock premium in the European market.

To some extent, there are abnormal returns in the sample not explained by the factor models: notice alphas at the 10 % level for the USA portfolio, the defense portfolio, and the gambling portfolio. However, the alpha is not robust across the different portfolios. For instance, the alpha is not notably significant across the other industry portfolios, the second time period portfolio or the Europe portfolio. Neither the alcohol nor tobacco portfolio had any sign of a sin stock premium but was explained by their favorable factor exposure instead. If there indeed was a sin stock premium present, this should be positive and significant in the regressions when diving into the different industries. It seems that the positive abnormal returns in the total sin portfolio are mainly driven by the positive alpha in the first time period and in the USA portfolio. The slightly significant alpha observed in some industry portfolios and in the USA portfolio could suggest that the asset pricing models applied have been inadequate or it could be caused by other industry- or geographic specific factors not related to a general sin premium. Since the alpha is not highly significant and robust across portfolios the evidence is not in favor of a sin stock premium.

7.1.3 Favorable factor exposures

The interpretation of the regression results for the total sin portfolio are that the returns are partly explained by the portfolio having positive exposure to the profitability- and investment factors, which is in line with the findings of Blitz and Fabozzi (2017) and Sagbakken and Zhang (2022). Overall, in the results it is the profitability factor, RMW, that is robustly significant in all the regressions mentioned in Table 7.1. It is apparent that the sin stocks in the sample have positive exposure to this factor premium. Positive factor exposures mean that investors are rewarded with positive premiums by investing in sin stocks. The exposure to the investment factor is positive and

significant in the total sin portfolio, but not in all the portfolios such as the Europe portfolio, the first-time period portfolio, and the alcohol- and gambling portfolio. This differs from the results of Blitz & Fabozzi (2017), where the investment factor was an overall robust explanatory variable.

7.2 Evidence and Hypothesis 2, 3 and 4

This section discusses the evidence of *Hypothesis 2: sin stocks with low ESG scores have abnormal returns; Hypothesis 3: sin stocks with high ESG scores have no abnormal returns; Hypothesis 4: sin stocks with low ESG scores have outperformed sin stocks with high ESG scores.* A summary of the alphas from the ESG portfolio regressions is provided in Table 7.2.

Table 7.2 Summary of alphas from ESG portfolio time-series regressions

Portfolio		Model	Alpha
Sin portfolio by ESG score: low ESG	*Table 6.5*	Five-factor model	0.0163***
Sin portfolio by ESG score: high ESG	*Table 6.5*	Five-factor model	-0.0011
Sin portfolio by pillar score: low Environmental	*Table 6.6*	Five-factor model	0.0128***
Sin portfolio by pillar score: high Environmental	*Table 6.6*	Five-factor model	-0.0025
Sin portfolio by pillar score: low Social	*Table 6.6*	Five-factor model	0.0147***
Sin portfolio by pillar score: high Social	*Table 6.6*	Five-factor model	-0.0011
Sin portfolio by pillar score: low Governance	*Table 6.6*	Five-factor model	0.0075**
Sin portfolio by pillar score: high Governance	*Table 6.6*	Five-factor model	-0.0026
Zero-net sin portfolio by ESG score	*Table 6.7*	Five-factor model	0.0174***
Zero-net sin portfolio by pillar score: Environmental	*Table 6.8*	Five-factor model	0.0153***
Zero-net sin portfolio by pillar score: Social	*Table 6.8*	Five-factor model	0.0158***
Zero-net sin portfolio by pillar score: Governance	*Table 6.8*	Five-factor model	0.0101***

*The table is a summary of time-series regressions of monthly returns on different value-weighted portfolios. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance.*

7.2.1 ESG risk premium?

The differences in returns for the sin stocks with low ESG scores and high ESG scores are obvious. Only the portfolios consisting of sin stocks with low ESG scores have positive significant alphas and sin stocks with high ESG scores have no abnormal returns. This evidence is robust for different portfolio variations. The zero-net portfolio regression by ESG score shows that the low-ESG portfolio outperformed the high-ESG portfolio by 1.74 % monthly, which is 23.00 % annualized, and obviously of monetary magnitude. The evidence from the regressions is robust enough to conclude that sin stocks with low ESG scores have had abnormal returns in the sample period, whilst sin stocks with high ESG scores have not. Furthermore, sin stocks with low ESG scores

have outperformed sin stocks with high ESG scores. Thus, the regression results confirm *Hypothesis 2, 3,* and *4*, and there are two important questions arising from this: are sin firms with high ESG scores able to moral rebalance? Is there a risk premium for firms who are lacking ESG practices?

The regression results could indicate that moral rebalancing is possible. As only the firms with low ESG scores have abnormal returns, this could indicate that the sin stocks with high ESG scores have been able to rebalance their sinfulness, i.e., reverse the potential financial consequences related to being a sinning firm (Sharma & Song, 2018). The reason for sorting sin stocks by ESG scores was to be able to differentiate firms into different levels of sin. The abnormal returns are only present for low ESG firms (i.e., firms who could be considered as more sinful), this suggests that there indeed are different levels of sin and that investors do not view sinfulness as a binary attribute.

On the other hand, it is not given that the abnormal returns are related to moral rebalancing or different levels of sinfulness. The abnormal return could be due to investors demanding additional returns for investing in a firm with low ESG scores as these firms are less adept at managing their ESG risks. This would be in line with the paper of Jo and Na (2012), who found a negative relationship between CSR and firm risk. Giese, Lee, Melas, Nagy, and Nishikawa (2019) claim that stocks with strong ESG profiles have better risk management, leading to a lower risk of severe incidents that could harm stock prices, thus a lower tail risk. Furthermore, they argue that firms with strong ESG profiles are less vulnerable to systematic market shocks due to their strong risk management and thus show lower systematic risk, meaning a decreased cost of capital. Their arguments are in line with the findings in this thesis. It indicates that the return patterns observed (sin stocks with low ESG scores have abnormal returns, whilst sin stocks with high ESG score do not) are due to an ESG risk premium, and not evidence of moral rebalancing or a sin premium. However, these effects are not mutually exclusive, and the abnormal results could be due to multiple effects. Still, the evidence is more in favor of the abnormal returns being an ESG risk premium as there was no robust sin stock premium present in the regressions related to *Hypothesis 1*.

7.2.2 Factor exposures

This thesis finds that factor exposures vary for the different ESG portfolios. Sin stocks with low ESG scores have positive factor exposure to the size factor, but no factor exposure to the profitability and investment factor. Sin stocks with high ESG scores have a negative factor exposure to the size factor and positive exposure to the profitability and investment factors. The factor exposures indicate that sin firms with low ESG scores are of small size, and that sin firms with high ESG scores are of larger size, profitable, and with conservative investment styles. Intuitively, it could make sense that the sin stocks with low ESG scores have exposure to the size premium: smaller firms could have fewer resources to improve and develop their ESG practices. In the recent papers published the size factor has been non-significant when controlling for profitability and investment (Sagbakken & Zhang, 2022; Blitz & Fabozzi, 2017). Thus, the regression results in this thesis contributes to the literature by showing that the factor exposures to the sin stocks differ by their ESG scores.

7.3 Limitations of the study

There are certain limitations to this study. The rating methodology of different ESG providers vary, and there can be large discrepancies between ESG scores from different providers (Kotsantonis & Serafeim, 2019). To provide insights, the thesis sample is compared to the sample of Paradis and Schiehll (2021) who conducted a study on the ESG scores of sin stocks using ESG scores from Morgan Stanley Capital International (MSCI). The MSCI ESG scores are on a scale from 0-10, whilst the Refinitiv scores are on a scale from 0-100. Multiplying the MSCI ESG scores by 10 allows a heuristic comparison of the ESG scores. The comparison is presented in Table 7.3.

Table 7.3 Average ESG score comparison

	Thesis sample	Paradis and Schiehll (2021)
ESG score	40.58	41.80
Environmental pillar score	38.33	46.90
Social pillar average	43.49	42.00
Governance pillar score	46.50	43.00

The table presents score averages for the sample in this thesis and the sample of Paradis and Schiehll (2021).

The samples have quite similar average scores, except for the environmental pillar where the sample in this thesis has a noticeably lower average. This may be due to their sample only including alcohol, gambling, and tobacco, whilst this thesis also includes the defense industry. Nevertheless, it is a healthy sign that the samples have quite similar ESG output when using different providers, as this indicates that the choice of ESG provider does not materially alter the output in this thesis. However, in this thesis, ESG scores from Refinitiv were only available for 95 sin stocks and this sample could preferably have been larger. Future research is encouraged to use multiple ESG providers as this may ensure a larger ESG sample and could provide further insights into a possible ESG premium.

8 Conclusion

First, this thesis sets out to answer the research question: *is there a sin stock premium?* Some of the portfolios show positive significant alphas, so *Hypothesis 1: sin stocks earn abnormal returns* cannot be rejected completely. However, the alphas are not highly significant and robust across portfolios so there is no robust evidence for a sin stock premium. The results of this thesis suggest that a general sin stock premium such as described in Hong and Kacperczyk (2009) and Fabozzi et al. (2008) is not present. Investors who invest in these industries will not achieve abnormal returns based on the sinfulness of the industry. However, the total sin stock portfolio shows an overall positive exposure to multiple factors, such as the profitability and investment factors. This means that their positive exposure is rewarded with positive premiums: hence, as long as they have positive factor exposure, their expected return will remain higher than the market. Excluding stocks, whether sinful or not, with positive factor exposures, will have a negative impact on the expected return of the portfolio (Blitz & Fabozzi, 2017, p. 6).

The second research question ask: *are there nuances to sin stocks when viewed through the ESG lens*? The results provide evidence in favor of *Hypothesis 2: sin stocks with low ESG scores have abnormal returns; Hypothesis 3: sin stocks with high ESG scores have no abnormal returns; Hypothesis 4: sin stocks with low ESG scores have outperformed sin stocks with high ESG scores.* The thesis finds that abnormal returns are only present for sin stocks with low ESG scores, and they strongly outperform sin stocks with high ESG scores. In line with the dominating rationale in the literature, the abnormal returns in the ESG portfolio may be an ESG premium: investors demand a risk premium for investing in firms with lack ESG practices. These findings are of a significant financial magnitude. Supported by the findings in this thesis, it is concluded that there are nuances to sin stocks when viewed through the ESG lens.

The majority of the literature views sin as something determined by its industry, and the findings in this thesis suggest that this view is outdated and that firms need to be evaluated in context with other metrics. A study on sin stocks gives insights into how social norms affect capital markets. There are abnormal returns found in this thesis suggesting a form of ESG premium, but whether this is due to ESG scores being a proxy for systematic risk or social norms affecting the capital markets remains open and future research is encouraged.

9 References

Amel-Zadeh, A., & Serafeim, G. (2018). Why and How Investors Use ESG Information: Evidence from a Global Survey. *Financial Analysts Journal, 74*(3), 87-103. https://doi.org/10.2469/faj.v74.n3.2

Blitz, D., & Fabozzi, F. J. (2017). Sin stocks revisited: Resolving the sin stock anomaly. *Journal of Portfolio Management 44*(1), 105-111. https://doi.org/10.3905/jpm.2017.44.1.105

Blitz, D., & Swinkels, L. (2021). Who owns tobacco stocks? *Journal of Asset Management*, *22*, 311-325. https://doi.org/10.1057/s41260-021-00224-2

Bodie, Z., Kane, A., & Markus, A. J. (2021). *Investments* (12 ed.). McGraw-Hill Education.

Cai, Y., Jo, H., & Pan, C. (2012). Doing well while doing bad? CSR in controversial industry sectors. *Journal of Business Ethics*, *108*(4), 467-480. https://doi.org/10.1007/s10551-011-1103-7

Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. *Journal of Finance, 52*(1), 57-87. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Copeland, T. E., Weston, J. F., & Shastri, K. (2005). *Financial Theory and Corporate Policy* (2 European ed.). Pearson Education, Inc.

Ellison, C. G., & McFarland, M. J. (2011). Religion and Gambling Among U.S. Adults: Exploring the Role of Traditions, Beliefs, Practices, and Networks*. *Journal for the Scientific Study of Religion, 50*(1), 82-102. https://doi.org/10.1111/j.1468-5906.2010.01553.x

Fabozzi, F. J., Ma, K. C., & Oliphant, B. J. (2008). Sin Stock Returns. *The Journal of Portfolio Management 35*(1), 82-94. https://doi.org/10.3905/JPM.2008.35.1.82

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance*, *47*(2), 427-465. https://doi.org/10.2307/2329112

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (2004). The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives, 18*(3), 25-46. https://doi.org/10.1257/0895330042162430

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*(1), 1-22. https://doi.org/10.1016/j.jfineco.2014.10.010

Fauver, L., & McDonald, M. B. (2014). International variation in sin stocks and its effects on equity valuation. *Journal of Corporate Finance*, *25*, 173-187. https://doi.org/10.1016/j.jcorpfin.2013.11.017

Frazzini, A., & Pedersen, L. H. (2014). Betting Against Beta. *Journal of Financial Economics*, *111*(1), 1-25. https://doi.org/10.1016/j.jfineco.2013.10.005

Gerard, B. (2019). ESG and Socially Responsible Investment: A Critical Review. *Beta*, *33*(1), 61-83. https://doi.org/10.18261/issn.1504-3134-2019-01-05

Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance. *The Journal of Portfolio Management*, *45*(5), 69-83. https://doi.org/10.3905/jpm.2019.45.5.069

Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. *Journal of Financial Economics*, *93*(1), 15-36. https://doi.org/10.1016/j.jfineco.2008.09.001

Jensen, M. C. (1968). The performance of mutual funds in the period 1945-1964. *The Journal of Finance*, *23*(2), 389-416. https://doi.org/10.1111/j.1540-6261.1968.tb00815.x

Jo, H., & Na, H. (2012). Does CSR reduce firm risk? Evidence from controversial industry sectors. *Journal of Business Ethics*, *110*(4), 441-456. https://doi.org/10.1007/s10551-012-1492-2

Kotchen, M., & Moon, J. J. (2012). Corporate Social Responsibility for Irresponsibility. *The B.E. Journal of Economic Analysis & Policy*, *12*(1), Article 55. https://doi.org/10.1515/1935-1682.3308

Kotsantonis, S., & Serafeim, G. (2019). Four Things No One Will Tell You About ESG Data. *Journal of Applied Corporate Finance*, *31*(2), 50-58.

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, *7*(1), 77-91. https://doi.org/10.2307/2975974

Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *Journal of Finance*, *42*, 483-510. https://doi.org/10.1111/j.1540-6261.1987.tb04565.x

National Council on Problem Gambling. (2018, February 2). *March is Problem Gambling Awareness Month [Press release]* https://www.ncpgambling.org/march-is-problem-gambling-awareness-month-2/

Nettleton, D. (2014). *Commercial Data Mining*. Morgan Kaufmann. https://doi.org/10.1016/B978-0-12-416602-8.00006-6

Newey, W. K., & West, K. D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica*, *55*(3), 703-708. https://doi.org/10.2307/1913610

Paradis, G., & Schiehll, E. (2021). ESG Outcasts: Study of the ESG Performance of Sin Stocks. *Sustainability*, *13*(17), 9556. https://doi.org/10.3390/su13179556

Pernod Ricard. (2018, September 24). *Pernod Ricard is recognized as a United Nations Global Compact Lead Company [Press release]* https://www.pernod-ricard.com/en/media/pernod-ricard-recognized-united-nations-global-compact-lead-company

Pullella, P. (2017, November 9). No more Holy Smokes - Vatican bans sale of cigarettes. *Reuters*. https://www.reuters.com/article/us-pope-cigarettes-idUSKBN1D91JI

Refinitiv. (2022). Environmental, Social and Governance Scores from Refinitiv [ESG scores methodology].

Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, *13*(3), 341-360. https://doi.org/10.1016/0022-0531(76)90046-6

Sagbakken, S. T., & Zhang, D. (2022). European sin stocks. *Journal of Asset Management*, *23*, 1-18. https://doi.org/10.1057/s41260-021-00247-9

Salaber, J. M. (2007). *The determinants of sin stock returns: Evidence on the European market* Paris Dauphine University].

Schwert, G. W. (2003). Anomalies and market efficiency. In M. H. a. R. S. Edited by G.M. Constantinides (Ed.), *Handbook of the Economics of Finance* (pp. 939-974). Elsevier Science B.V. https://doi.org/10.1016/S1574-0102(03)01024-0

Sharma, Z., & Song, L. (2018). Corporate social responsibility (CSR) practices by SIN firms. *Asian Review of Accounting*, *26*(3), 359-372. https://doi.org/10.1108/ARA-06-2017-0102

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *Journal of Finance*, *19*(3), 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Studenmund, A. H. (2017). *A Practical Guide to Using Econometrics* (Seventh Edition ed.). Pearson Education Limited.

Trinks, P. J., & Scholtens, B. (2017). The Opportunity Cost of Negative Screening in Socially Responsible Investing. *Journal of Business Ethics*, *140*(2), 193-208. https://doi.org/10.1007/s10551-015-2684-3

US Department of Health and Human Services (Centers for Disease Control and Prevention) (2022). *National Vital Statistics System – Mortality Data (2020)*. https://www.cdc.gov/nchs/fastats/injury.htm

US SIF: The Forum for Sustainable and Responsible Investment. *Sustainable Investing Basics*. Retrieved 22.03.22 from https://www.ussif.org/sribasics

US SIF: The Forum for Sustainable and Responsible Investment. (2020). *Report on US Sustainable and Impact Investing Trends 2020* (13).

Wooldridge, J. M. (2012). *Introductory econometrics - a modern approach* (5 ed.). Cengage Learning.

World Health Organization. (2021). *WHO report on the global tobacco epidemic 2021: addressing new and emerging products*. https://www.who.int/teams/health-promotion/tobacco-control/global-tobacco-report-2021

Appendix A. The Refinitiv Business Classification System

The sin sample is based on The Refinitiv Business Classification System (TRBC), which is presented in Table A.1.

Table A.1 The Refinitiv Business Classification System

Industry	Activity	TRBC ID
Aerospace & Defense	Aerospace & defence (NEC)	4294951866
Aerospace & Defense	Arms and ammunitions manufacturing	4294951865
Aerospace & Defense	Military aircraft manufacturing	4294951863
Aerospace & Defense	Military vehicles manufacturing	4294951861
Aerospace & Defense	Military clothing and accessories	4294951858
Casinos & Gaming	Casinos and gaming (NEC)	4294951588
Casinos & Gaming	Gambling and gaming machine	4294951587
Casinos & Gaming	Gaming machine	4294951586
Casinos & Gaming	Casinos	4294951585
Casinos & Gaming	Horse and dog race tracks	4294951584
Casinos & Gaming	Lottery operators	4294951583
Brewers	Brewers (NEC)	4294951476
Brewers	Craft and micro brewers	4294951475
Distilleries and wineries	Distilleries and wineries (NEC)	4294951474
Distilleries and wineries	Wineries	4294951473
Distilleries and wineries	Distilleries	4294951472
Distilleries and wineries	Malt producers	4294951471
Tobacco	Tobacco (NEC)	4294951423
Tobacco	Tobacco farming	4294951422
Tobacco	Tobacco stemming and redrying	4294951421
Tobacco	Cigars and cigarette manufacturing	4294951420
Tobacco	Chewing tobacco products	4294951419
Food Retail and distribution	Beer, wine, and liquor stores	4294951390
Food Retail and distribution	Tobacco stores	4294951388

The table presents all the TRBC ID codes, and their belonging industry and activity descriptions, included in the sample.

Appendix B. Sample by country and industry

Table B.1 shows the sin stock sample by country and industry. The country in Europe with the most sin stocks is Great Britain, followed by France, Germany, and Sweden.

Table B.1 Sample by country and industry

Country	Alcohol	Defense	Gambling	Tobacco	*Total*
Austria	3	0	0	0	*3*
Belgium	2	0	0	0	*2*
Denmark	4	0	0	1	*5*
Finland	2	0	0	0	*2*
France	9	4	4	0	*17*
Germany	9	1	4	0	*14*
Great Britain	12	6	6	2	*26*
Greece	2	0	1	1	*4*
Ireland	1	0	1	0	*2*
Italy	4	1	0	0	*5*
Netherlands	3	0	0	0	*3*
Norway	1	1	0	0	*2*
Portugal	0	0	1	0	*1*
Spain	1	0	1	0	*2*
Sweden	4	2	6	2	*14*
Switzerland	0	0	1	0	*1*
USA	35	56	43	24	*158*
Total	**92**	**71**	**68**	**30**	***261***

The table presents number of firms in the sample by their country of headquarters.

Appendix C. Portfolio distribution and residual analysis

In this Appendix histograms of the standardized residuals, quantile-quantile plots (hereby: QQ-plot) and residual scatter plots are provided for the total sin portfolio, the low-ESG portfolio, and the high-ESG portfolio. This is to test for normality and ensure that the Gauss-Markov assumption *IV) Zero conditional mean* is met.

A normally distributed error term is not required for OLS estimation; however, it is important for hypothesis testing (Studenmund, 2017, p. 117). The Central Limit Theorem states that regardless of the population's distribution, the distribution of the sample mean approaches normality as the size of observation increases (Wooldridge, 2012). Since the sample size in this thesis has 252 observations for the total sin portfolio and 120 for the ESG portfolio, it is fair to assume one can rely on the Central Limit Theorem and assume that the sampling distribution of the mean is approximately normal. However, an analysis is still conducted to ensure normality and that the zero conditional mean assumption is met. In summary, the analysis indicates that the residuals are normally distributed around zero, with limited skewness. Thus, the conditions for normality and the Gauss-Markov assumption *IV) Zero conditional mean* are met.

C.1 The sin portfolio

The QQ-plot is linear, and the histogram of standardized residuals shows an approximately symmetric bell-shaped histogram evenly distributed around zero, with some positive kurtosis. In the residual scatter plot, there is only white noise, i.e., no systematical patterns in the residuals.

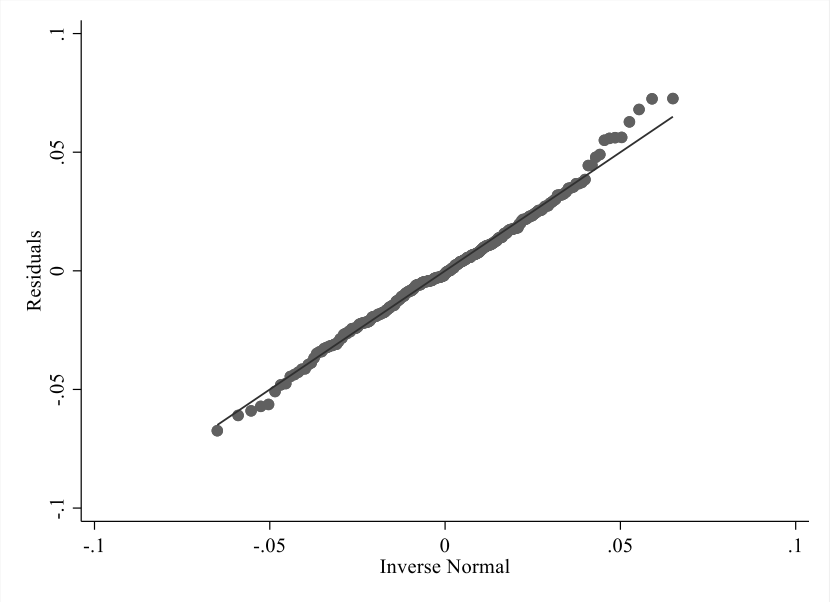


Figure C.1 QQ-plot for the total sin portfolio

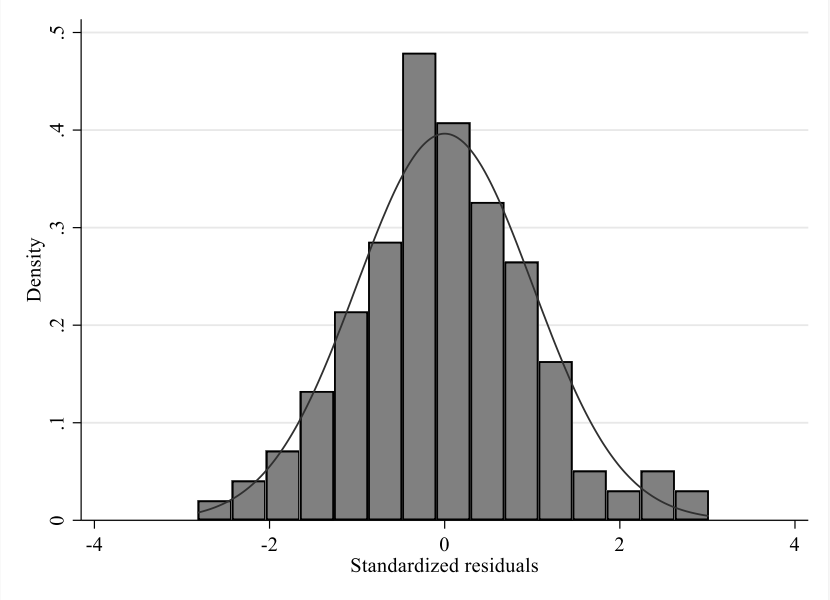


Figure C.2 Histogram of standardized residuals for the total sin portfolio

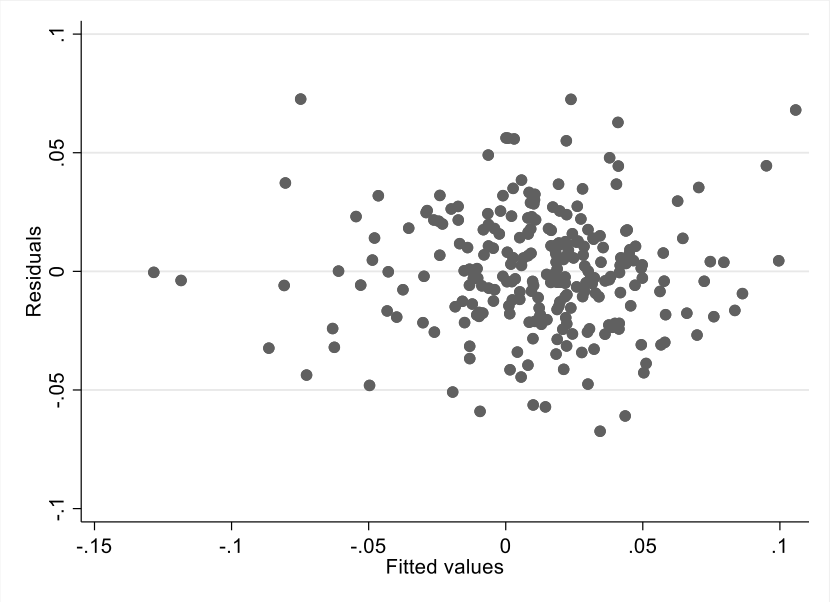


Figure C.3 Residual scatter plot for the total sin portfolio

C.2 The low-ESG portfolio

The QQ-plot shows indications of over-dispersed data, meaning positive excess kurtosis, which is further confirmed by the histogram. The histogram shows a bell-shaped curve, but with slight positive skewness. The scatter plots of the low-ESG portfolio show some clustering and some outliers. This is as expected as results from the Breusch-Pagan tests (see Chapter 5.6.1) indicated heteroskedasticity in the sample. As mentioned in Chapter 5.6.1, the remedy used is in the time-series regressions is Newey-West standard errors.

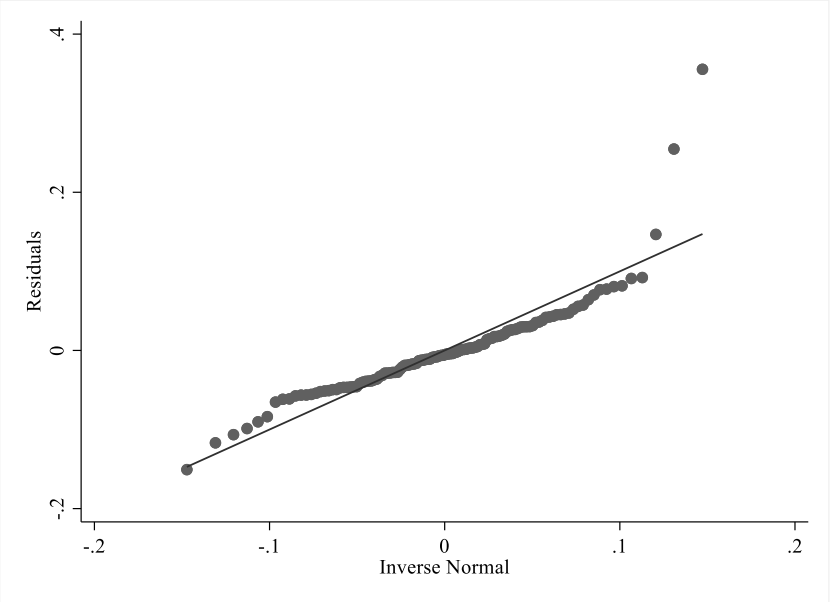


Figure C.4 QQ-plot for the low-ESG portfolio

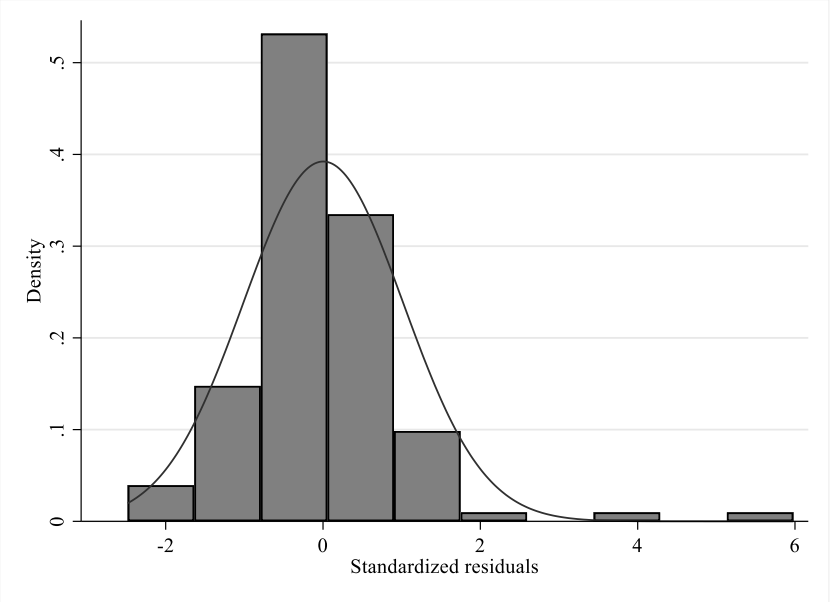


Figure C.5 Histogram of standardized residuals for the low-ESG portfolio

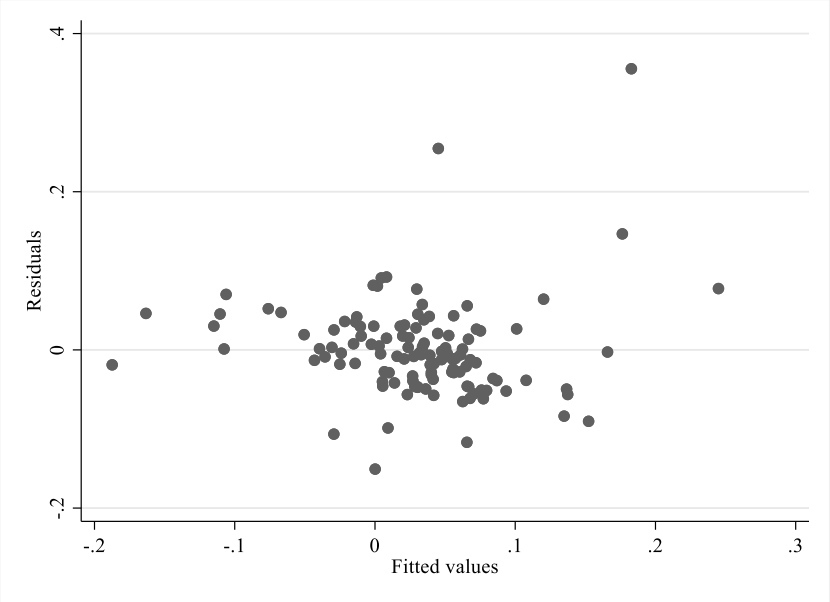


Figure C.6 Residual scatter plot for the low-ESG portfolio

C.3 The high-ESG portfolio

The QQ-plot is linear with some outliers, and the histogram shows a bell-shaped curve with slight positive kurtosis and limited skewness. The scatter plot for the high-ESG portfolio does not show any prominent systematic patterns, only white noise.

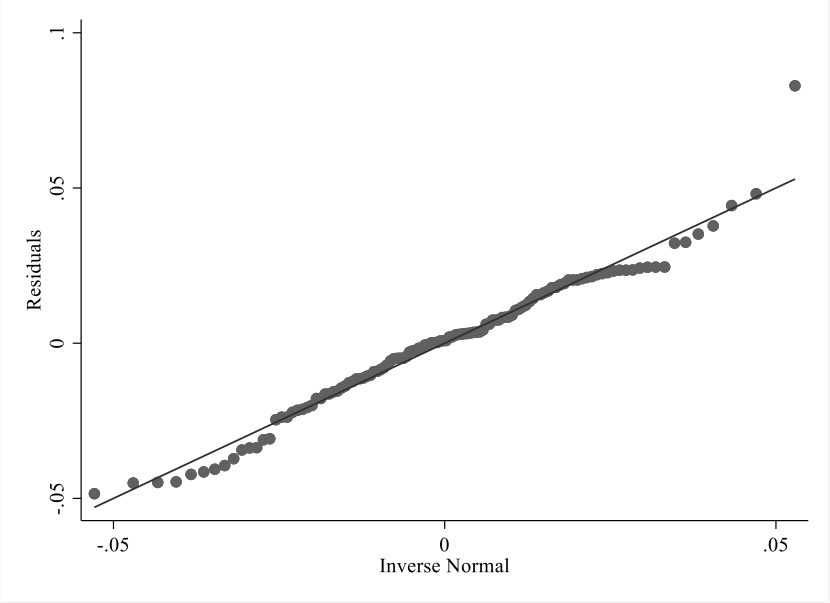


Figure C.7 QQ-plot for the high-ESG portfolio

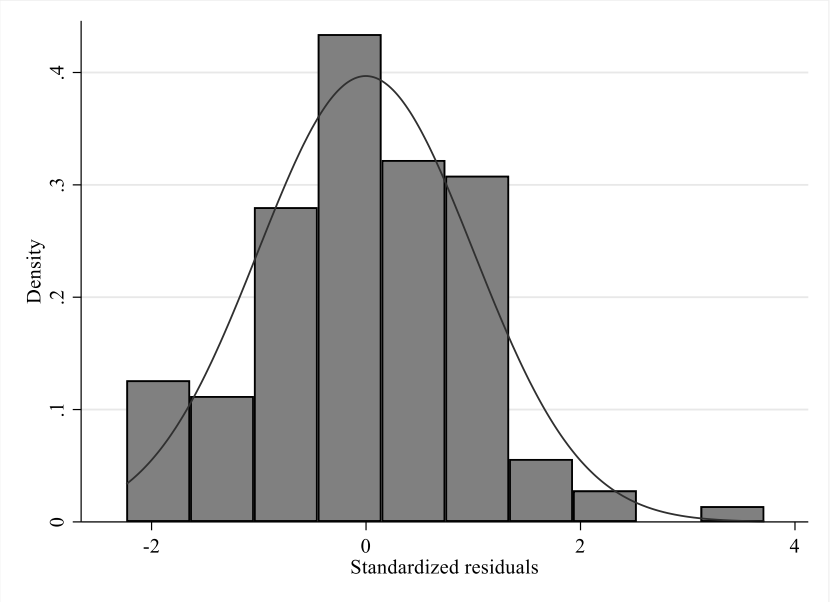


Figure C.8 Histogram of standardized residuals for the high-ESG portfolio

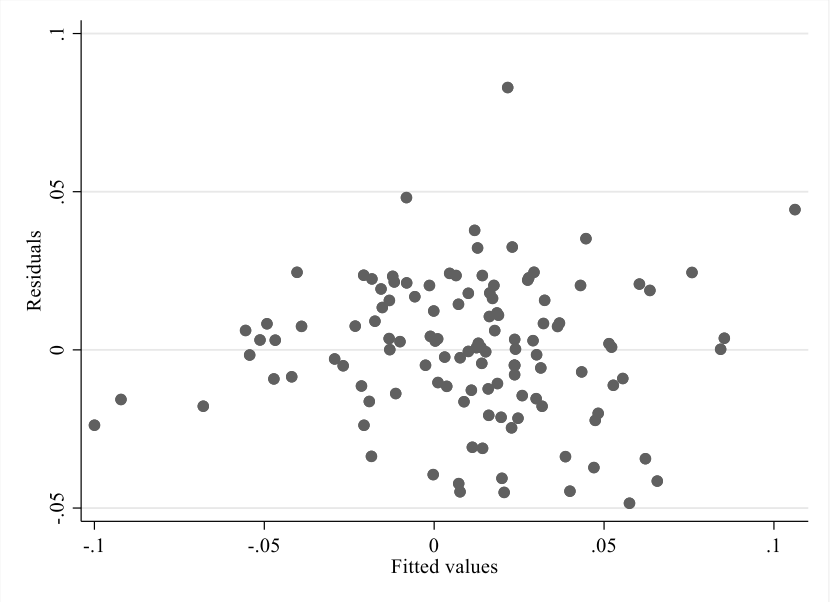


Figure C.9 Residual scatter plot for the high-ESG portfolio

Appendix D. Continent portfolios

Table D.1 presents the regression results for the USA portfolio and Table D.2 presents the Europe portfolio. The alpha for the USA portfolio is significant at a 1 % level throughout model (1) to (4). However, when the profitability and investment factors are introduced in the five-factor model the alpha is notably reduced and only significant at the 10 % level. The same pattern is visible in the regression for the EU portfolio, where there is no significant alpha in the five-factor model and its variations. Thus, there are no indications of abnormal returns in the EU. The positive and highly significant profitability factor is an important explanatory variable for both portfolios.

Table D.1 Regression results for the monthly returns net risk-free rate for the USA portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0083*** **	**0.0079*** **	**0.0073*** **	**0.0064*** **	**0.0036***	**0.0037***	**0.0038***
	(4.1218)	(4.0735)	(3.6894)	(3.0983)	(1.8386)	(1.8719)	(1.9233)
Mrkt-Rf	**0.8413*** **	**0.8502*** **	**0.8844*** **	**0.8712*** **	**0.9870*** **	**0.9765*** **	**0.9865*** **
	(19.0621)	(19.7998)	(18.4631)	(19.9310)	(20.6305)	(19.9690)	(20.5911)
SMB		-0.1395	-0.1510	-0.1987	0.0222	0.0437	0.0480
		(-1.1751)	(-1.2735)	(-1.6423)	(0.1948)	(0.3780)	(0.3961)
HML		**0.3588*** **	**0.3714*** **	**0.3124*** **	**0.2196***	0.1872	**0.2328** **
		(4.3080)	(4.4532)	(3.6583)	(1.9125)	(1.5733)	(1.9917)
WML			0.0908			-0.0622	
			(1.5896)			(-1.0353)	
BAB				**0.1540** **			-0.0486
				(2.1652)			(-0.6261)
RMW					**0.7709*** **	**0.8256*** **	**0.8195*** **
					(5.4660)	(5.4826)	(5.0868)
CMA					**0.4033** **	**0.4544*** **	**0.4066** **
					(2.5077)	(2.7015)	(2.5238)
R^2	0.5924	0.6221	0.6259	0.6291	0.6703	0.6717	0.6708
Adjusted R^2	0.5908	0.6175	0.6199	0.6231	0.6636	0.6637	0.6628
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in the USA net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table D.2 Regression results for the monthly returns net risk-free rate for the Europe portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0074*** **	**0.0073*** **	**0.0062*** **	**0.0054** **	0.0027	0.0027	0.0028
	(3.4428)	(3.4130)	(2.8533)	(2.3788)	(1.2399)	(1.2228)	(1.2848)
Mrkt-Rf	**0.5559*** **	**0.5631*** **	**0.6265*** **	**0.5895*** **	**0.6979*** **	**0.7028*** **	**0.6976*** **
	(11.7446)	(11.8516)	(11.9308)	(12.2213)	(13.1688)	(12.9517)	(13.1373)
SMB		-0.1510	-0.1723	**-0.2253***	0.0019	-0.0082	0.0185
		(-1.1494)	(-1.3256)	(-1.6882)	(0.0151)	(-0.0641)	(0.1379)
HML		0.1327	**0.1561***	0.0744	0.0709	0.0861	0.0794
		(1.4395)	(1.7075)	(0.7894)	(0.5574)	(0.6521)	(0.6129)
WML			**0.1684*** **			0.0292	
			(2.6894)			(0.4384)	
BAB				**0.1935** **			-0.0313
				(2.4661)			(-0.3635)
RMW					**0.9026*** **	**0.8770*** **	**0.9339*** **
					(5.7777)	(5.2479)	(5.2307)
CMA					0.2733	0.2493	0.2755
					(1.5344)	(1.3356)	(1.5428)
R^2	0.3556	0.3639	0.3820	0.3792	0.4438	0.4443	0.4441
Adjusted R^2	0.3530	0.3562	0.3720	0.3691	0.4325	0.4306	0.4305
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in Europe net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Appendix E. Time period portfolios

The original time period in the sample is divided in two, Table E.1 presents the regression results for the first time period and Table E.2 presents the second time period. There are indications of a sin stock premium in the first time period as the alpha remains significant at the 5 % level throughout the models. In the second time period the alpha is barely significant in the CAPM (1) model but loses its significance in the other models. The results are clearly indicating that there are no abnormal returns in the second time period. Neither the size factor nor the Momentum factor and Betting-Against-Beta are significant explanatory variables for either portfolio. However, the profitability factor is positive and significant which is in line with previous regression results in this thesis.

Table E.1 Regression results for the monthly returns net risk-free rate for the first time period *(January 2001 – June 2011)*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0110*** **	**0.0082*** **	**0.0081*** **	**0.0074*** **	**0.0053** **	**0.0051** **	**0.0053** **
	(4.2701)	(3.2566)	(3.1819)	(2.8792)	(2.0600)	(1.9899)	(2.0728)
Mrkt-Rf	**0.6236*** **	**0.6464*** **	**0.6684*** **	**0.6657*** **	**0.7661*** **	**0.7590*** **	**0.7670*** **
	(11.8586)	(12.9145)	(11.6239)	(13.0070)	(12.0146)	(11.7378)	(11.9782)
SMB		0.0368	0.0274	-0.0236	0.0780	0.0932	0.0961
		(0.2674)	(0.1977)	(-0.1664)	(0.5851)	(0.6889)	(0.6783)
HML		**0.4797*** **	**0.4597*** **	**0.3936*** **	**0.3288** **	**0.3188** **	**0.3466** **
		(4.3017)	(4.0108)	(3.1948)	(2.1263)	(2.0492)	(2.1422)
WML			0.0498			-0.0482	
			(0.7809)			(-0.7123)	
BAB				0.1252			-0.0350
				(1.5998)			(-0.3892)
RMW					**0.6733*** **	**0.7282*** **	**0.7166*** **
					(3.6959)	(3.6750)	(3.3491)
CMA					0.1367	0.1754	0.1354
					(0.7598)	(0.9318)	(0.7500)
R^2	0.5314	0.5938	0.5958	0.6022	0.6361	0.6377	0.6366
Adjusted R^2	0.5276	0.5838	0.5825	0.5891	0.6210	0.6194	0.6183
Observations	126	126	126	126	126	126	126

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in net risk-free rate over the period January 2001 - June 2011 (126 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table E.2 Regression results for the monthly returns net risk-free rate for the second time period

(July 2011 – December 2021)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0041***	0.0031	0.0029	0.0029	0.0010	0.0012	0.0021
	(1.7510)	(1.3517)	(1.2379)	(1.1551)	(0.4565)	(0.5194)	(0.8808)
Mrkt-Rf	**0.8306*****	**0.8539*****	**0.8630*****	**0.8550*****	**0.9212*****	**0.9153*****	**0.9195*****
	(14.7387)	(15.3657)	(14.4778)	(15.2031)	(16.5630)	(15.8676)	(16.5594)
SMB		**-0.4699*****	**-0.4696*****	**-0.4739*****	**-0.1618**	**-0.1588**	**-0.1099**
		(-3.0353)	(-3.0228)	(-3.0073)	(-1.0135)	(-0.9897)	(-0.6657)
HML		-0.0327	-0.0040	-0.0319	-0.0869	-0.1277	-0.1170
		(-0.3455)	(-0.0347)	(-0.3354)	(-0.5576)	(-0.6848)	(-0.7427)
WML			0.0444			-0.0406	
			(0.4319)			(-0.4017)	
BAB				0.0185			-0.1414
				(0.1535)			(-1.2019)
RMW					**0.6820*****	**0.6790*****	**0.7195*****
					(3.3177)	(3.2893)	(3.4668)
CMA					**0.6245****	**0.6581****	**0.6941****
					(2.3948)	(2.3955)	(2.6030)
R^2	0.6366	0.6624	0.6629	0.6625	0.7087	0.7091	0.7122
Adjusted R^2	0.6337	0.6541	0.6518	0.6513	0.6966	0.6944	0.6977
Observations	126	126	126	126	126	126	126

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in net risk-free rate over the period July 2011 - December 2021 (126 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Appendix F. Industry portfolios

This appendix includes four regression tables for each of the sin industries: Table F.1 presents the alcohol portfolio; Table F.2 presents the defense portfolio; Table F.3 presents the gambling portfolio; Table F.4 presents the tobacco portfolio. To summarize the tables: the alpha loses its significance when controlling for the profitability and investment factors for the alcohol and tobacco portfolio; the alpha remains significant at the 10 % level for the defense and gambling portfolio throughout the models; the profitability factor is positive and significant for all portfolios. The abnormal returns are not robust across the industry portfolios, which indicates that there is no general sin stock premium as this should have been present in all the industries.

Table F.1 Regression results for the alcohol portfolio's monthly returns net risk-free rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0066*** **	**0.0066*** **	**0.0053** **	0.0039	0.0016	0.0015	0.0015
	(2.7654)	(2.7475)	(2.1794)	(1.5453)	(0.6641)	(0.6384)	(0.5897)
Mrkt-Rf	**0.5742*** **	**0.5816*** **	**0.6544*** **	**0.6184*** **	**0.7110*** **	**0.7205*** **	**0.7113*** **
	(10.8948)	(10.9703)	(11.1774)	(11.5697)	(12.0280)	(11.9120)	(12.0094)
SMB		-0.1605	-0.1849	**-0.2641***	-0.0050	-0.0244	-0.0208
		(-1.0948)	(-1.2762)	(-1.7859)	(-0.0358)	(-0.1708)	(-0.1389)
HML		0.1094	0.1364	0.0282	0.1388	0.1679	0.1307
		(1.0644)	(1.3379)	(0.2699)	(0.9780)	(1.1409)	(0.9043)
WML			**0.1933*** **			0.0560	
			(2.7687)			(0.7536)	
BAB				**0.2699*** **			0.0297
				(3.1034)			(0.3094)
RMW					**1.0444*** **	**0.9951*** **	**1.0147*** **
					(5.9929)	(5.3428)	(5.0947)
CMA					0.1122	0.0661	0.1101
					(0.5645)	(0.3178)	(0.5530)
R^2	0.3219	0.3280	0.3482	0.3532	0.4128	0.4141	0.4130
Adjusted R^2	0.3192	0.3198	0.3376	0.3427	0.4009	0.3998	0.3986
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in the alcohol industry net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table F.2 Regression results for the defense portfolio's monthly returns net risk-free rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0064*** **	**0.0061*** **	**0.0059*** **	**0.0062*** **	**0.0039***	**0.0040***	**0.0046** **
	(3.2322)	(3.1482)	(2.9879)	(2.9727)	(1.8843)	(1.9148)	(2.1707)
Mrkt-Rf	**0.8102*** **	**0.8181*** **	**0.8282*** **	**0.8173*** **	**0.8950*** **	**0.8846*** **	**0.8936*** **
	(18.4358)	(18.9915)	(17.1563)	(18.4668)	(17.7267)	(17.1372)	(17.7545)
SMB		-0.1208	-0.1243	-0.1188	-0.0239	-0.0027	0.0463
		(-1.0148)	(-1.0398)	(-0.9698)	(-0.1993)	(-0.0217)	(0.3639)
HML		**0.3224*** **	**0.3262*** **	**0.3241*** **	**0.2156***	**0.1836**	**0.2515** **
		(3.8600)	(3.8810)	(3.7478)	(1.7788)	(1.4615)	(2.0480)
WML			0.0269			-0.0614	
			(0.4679)			(-0.9685)	
BAB				-0.0053			-0.1322
				(-0.0742)			(-1.6209)
RMW					**0.3721** **	**0.4261*** **	**0.5042*** **
					(2.5003)	(2.6809)	(2.9791)
CMA					**0.2853***	**0.3358***	**0.2943***
					(1.6813)	(1.8914)	(1.7392)
R^2	0.5762	0.6012	0.6016	0.6012	0.6149	0.6164	0.6190
Adjusted R^2	0.5745	0.5964	0.5951	0.5948	0.6071	0.6070	0.6097
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in the defense industry net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table F.3 Regression results for the gambling portfolio's monthly returns net risk-free rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0140*** **	**0.0128*** **	**0.0153*** **	**0.0148*** **	**0.0085***	**0.0091** **	**0.0116** **
	(3.0886)	(2.9223)	(3.4654)	(3.1673)	(1.8442)	(2.0462)	(2.5344)
Mrkt-Rf	**1.4529*** **	**1.4188*** **	**1.2825*** **	**1.3918*** **	**1.4711*** **	**1.3727*** **	**1.4645*** **
	(14.5201)	(14.5774)	(11.9420)	(13.9594)	(13.0614)	(12.3301)	(13.2949)
SMB		**0.9638*** **	**1.0097*** **	**1.0400*** **	**1.0771*** **	**1.2789*** **	**1.4097*** **
		(3.5823)	(3.7982)	(3.7691)	(4.0197)	(4.8556)	(5.0586)
HML		**0.4584** **	**0.4079** **	**0.5180*** **	**0.6839** **	**0.3806**	**0.8540*** **
		(2.4284)	(2.1813)	(2.6595)	(2.5296)	(1.4049)	(3.1771)
WML			**-0.3621*** **			**-0.5822*** **	
			(-2.8276)			(-4.2583)	
BAB				-0.1982			**-0.6256*** **
				(-1.2218)			(-3.5049)
RMW					**1.0705*** **	**1.5825*** **	**1.6952*** **
					(3.2240)	(4.6162)	(4.5769)
CMA					-0.6023	-0.1233	-0.5596
					(-1.5909)	(-0.3221)	(-1.5110)
R^2	0.4575	0.4973	0.5131	0.5003	0.5268	0.5594	0.5494
Adjusted R^2	0.4553	0.4912	0.5052	0.4922	0.5172	0.5486	0.5384
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in the gambling industry net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table F.4 Regression results for the tobacco portfolio's monthly returns net risk-free rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0075****	**0.0074****	**0.0061***	0.0045	0.0013	0.0013	0.0010
	(2.3812)	(2.3829)	(1.9180)	(1.3690)	(0.3945)	(0.3970)	(0.3081)
Mrkt-Rf	**0.5426*****	**0.5614*****	**0.6370*****	**0.6013*****	**0.7766*****	**0.7748*****	**0.7771*****
	(7.7998)	(8.1182)	(8.2953)	(8.5746)	(9.9585)	(9.6994)	(9.9469)
SMB		**-0.4090****	**-0.4344****	**-0.5217*****	**-0.1885**	**-0.1849**	**-0.2155**
		(-2.1395)	(-2.2857)	(-2.6881)	(-1.0163)	(-0.9782)	(-1.0902)
HML		**0.2696****	**0.2976****	0.1813	-0.0026	-0.0081	-0.0163
		(2.0103)	(2.2258)	(1.3235)	(-0.0137)	(-0.0417)	(-0.0857)
WML			**0.2009****			-0.0106	
			(2.1941)			(-0.1084)	
BAB				**0.2932****			0.0507
				(2.5701)			(0.4001)
RMW					**1.0522*****	**1.0615*****	**1.0016*****
					(4.5769)	(4.3155)	(3.8127)
CMA					**0.7842*****	**0.7930*****	**0.7808*****
					(2.9920)	(2.8861)	(2.9721)
R^2	0.1957	0.2215	0.2364	0.2418	0.3042	0.3042	0.3046
Adjusted R^2	0.1925	0.2121	0.2240	0.2295	0.2901	0.2872	0.2876
Observations	252	252	252	252	252	252	252

*The table reports time-series regressions of monthly returns on the value-weighted portfolio of sin stocks in the tobacco industry net risk-free rate over the period January 2001- December 2021 (252 months). T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Appendix G. ESG portfolios

Table G.1 presents the regression results for the low-ESG portfolio and Table G.2 presents the high-ESG portfolio. The low-ESG portfolio has a positive significant alpha throughout all the models indicating a form of premium related to this portfolio. Interestingly, neither the profitability nor investment factor is significant, but the size factor is an important explanatory variable. On the contrary, the are no abnormal returns in any of the models for the high-ESG portfolio. The profitability and investment factors are positive and significant, and the size factor is significant with a negative coefficient. The results show that the returns for the portfolios are driven by different factor exposures.

Table G.1 Regression results for the monthly returns net risk-free rate for the low-ESG portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0164*** **	**0.0173*** **	**0.0184*** **	**0.0200*** **	**0.0163*** **	**0.0172*** **	**0.0189*** **
	(2.7229)	(3.1098)	(3.0125)	(3.1565)	(2.9796)	(2.9319)	(3.0379)
Mrkt-Rf	**1.3770*** **	**1.3209*** **	**1.2698*** **	**1.3100*** **	**1.2875*** **	**1.2513*** **	**1.2894*** **
	(6.7185)	(7.0434)	(7.4815)	(7.0420)	(6.6887)	(7.1164)	(6.9226)
SMB		**2.0847*** **	**2.0810*** **	**2.1346*** **	**2.1843*** **	**2.2000*** **	**2.2849*** **
		(3.7272)	(3.7179)	(3.8681)	(3.4190)	(3.4153)	(3.6935)
HML		**-0.6642***	**-0.8039***	**-0.6807***	**-0.6446***	**-0.8363***	**-0.7198***
		(-1.8635)	(-1.9674)	(-1.9237)	(-1.7203)	(-1.7972)	(-1.8294)
WML			-0.2147			-0.2029	
			(-0.8262)			(-0.7566)	
BAB				-0.2907			-0.3175
				(-0.8508)			(-0.8981)
RMW					0.3522	0.3541	0.4258
					(0.4949)	(0.4877)	(0.6131)
CMA					-0.4487	-0.3020	-0.2858
					(-0.6742)	(-0.4413)	(-0.3820)
R^2	0.3626	0.5119	0.5146	0.5156	0.5139	0.5160	0.5179
Adjusted R^2	0.3572	0.4993	0.4977	0.4988	0.4925	0.4903	0.4923
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on a value-weighted portfolio of sin stocks net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with ESG scores are ranked from top to bottom by their average ESG score. The firms in the bottom third constitute the low-ESG portfolio. The portfolio is value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table G.2 Regression results for the monthly returns net risk-free rate for the high-ESG portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	0.0015	0.0005	0.0002	-0.0000	-0.0011	-0.0009	-0.0003
	(0.5965)	(0.2318)	(0.0905)	(-0.0012)	(-0.5651)	(-0.4286)	(-0.1080)
Mrkt-Rf	**0.8196*** **	**0.8517*** **	**0.8661*** **	**0.8539*** **	**0.9199*** **	**0.9107*** **	**0.9205*** **
	(12.8201)	(13.1582)	(12.1825)	(13.1538)	(15.7643)	(15.4437)	(15.9881)
SMB		**-0.6643*** **	**-0.6632*** **	**-0.6741*** **	**-0.3754** **	**-0.3714** **	**-0.3426** **
		(-4.5702)	(-4.5206)	(-4.4922)	(-2.4864)	(-2.4351)	(-2.0810)
HML		0.0397	0.0791	0.0430	-0.0920	-0.1409	-0.1166
		(0.4263)	(0.6798)	(0.4660)	(-0.6632)	(-0.8014)	(-0.7324)
WML			0.0606			-0.0517	
			(0.4913)			(-0.4491)	
BAB				0.0571			-0.1035
				(0.3919)			(-0.7008)
RMW					**0.5537** **	**0.5542** **	**0.5777** **
					(2.2733)	(2.2265)	(2.3418)
CMA					**0.8063*** **	**0.8436*** **	**0.8594*** **
					(3.9376)	(3.7756)	(3.6706)
R^2	0.6003	0.6560	0.6569	0.6566	0.7061	0.7067	0.7081
Adjusted R^2	0.5969	0.6471	0.6450	0.6447	0.6932	0.6912	0.6926
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on a value-weighted portfolio of sin stocks net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with ESG scores are ranked from top to bottom by their average ESG score. The firms in the top third constitute the high-ESG portfolio. The portfolio is value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Appendix H. Pillar portfolios

The tables in this appendix present regression results of the pillar portfolios: Table H.1 presents the low-Environmental pillar portfolio; Table H.2 presents the high-Environmental pillar portfolio; Table H.3 presents the low-Social pillar portfolio; Table H.4 presents the high Social pillar portfolio; Table H.5 presents the low-Governance pillar portfolio; Table H.6 presents the high-Governance pillar portfolio.

There are multiple similarities between the low-Environmental, low-Social, and low-Governance pillar portfolios regression results: they all have positive and highly significant alphas throughout the models; they have positive exposure to the size premium; they have no significant exposure to the Momentum factor, Betting-Against-Beta factor, profitability, or investment factor. The regression results for the high-Environmental, high-Social, and high-Governance pillar portfolios have multiple things in common: neither indicates any abnormal returns; they all have positive factor exposures to the profitability and investment factors; they all have negative factor exposure to the size factor. Overall, the regression results show that there are no abnormal returns for the portfolios with high pillar scores, but there have been positive significant abnormal returns for the portfolios with low pillar scores, indicating a form of premium.

Table H.1 Regression results for the monthly returns net risk-free rate for the low-Environmental pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0125****	**0.0135*****	**0.0147*****	**0.0162*****	**0.0128*****	**0.0139*****	**0.0155*****
	(2.6082)	(2.9775)	(2.9884)	(3.2839)	(3.0102)	(3.0492)	(3.2866)
Mrkt-Rf	**1.1624*****	**1.1176*****	**1.0620*****	**1.1062*****	**1.0974*****	**1.0554*****	**1.0994*****
	(7.5353)	(7.8194)	(7.8658)	(7.7621)	(7.7661)	(7.8368)	(8.0446)
SMB		**1.4251*****	**1.4212*****	**1.4772*****	**1.4818*****	**1.5000*****	**1.5864*****
		(3.0833)	(3.0822)	(3.2347)	(2.8431)	(2.8639)	(3.0835)
HML		-0.3759	-0.5279	-0.3931	-0.3850	**-0.6078***	-0.4633
		(-1.3491)	(-1.6236)	(-1.4098)	(-1.3784)	(-1.7619)	(-1.5718)
WML			-0.2336			-0.2356	
			(-1.2390)			(-1.1961)	
BAB				-0.3028			-0.3302
				(-1.2402)			(-1.2580)
RMW					0.1999	0.2021	0.2764
					(0.3196)	(0.3157)	(0.4435)
CMA					-0.2740	-0.1037	-0.1046
					(-0.5513)	(-0.2062)	(-0.1883)
R^2	0.4003	0.5009	0.5058	0.5072	0.5015	0.5060	0.5083
Adjusted R^2	0.3952	0.4880	0.4886	0.4901	0.4797	0.4798	0.4822
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with environmental pillar scores are ranked from top to bottom by their average pillar scores: the firms in the bottom third constitute the low-Environmental pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table H.2 Regression results for the monthly returns net risk-free rate for the high-Environmental pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	0.0005	-0.0007	-0.0012	-0.0011	-0.0025	-0.0024	-0.0014
	(0.1961)	(-0.2685)	(-0.4998)	(-0.3739)	(-1.1716)	(-1.1101)	(-0.5228)
Mrkt-Rf	**0.8422*** **	**0.8802*** **	**0.9067*** **	**0.8821*** **	**0.9533*** **	**0.9522*** **	**0.9541*** **
	(11.6627)	(11.9166)	(11.5924)	(11.9162)	(14.2952)	(14.5091)	(14.5367)
SMB		**-0.6845*** **	**-0.6826*** **	**-0.6930*** **	**-0.3607** **	**-0.3603** **	**-0.3201* **
		(-4.3539)	(-4.2813)	(-4.2881)	(-2.1960)	(-2.1696)	(-1.8069)
HML		-0.0176	0.0548	-0.0148	-0.1529	-0.1589	-0.1833
		(-0.1684)	(0.4392)	(-0.1426)	(-1.0727)	(-0.8902)	(-1.0879)
WML			0.1113			-0.0063	
			(0.8315)			(-0.0494)	
BAB				0.0496			-0.1282
				(0.3126)			(-0.8072)
RMW					**0.6318** **	**0.6318** **	**0.6615** **
					(2.2571)	(2.2430)	(2.3521)
CMA					**0.8626*** **	**0.8672*** **	**0.9284*** **
					(3.8791)	(3.5886)	(3.6005)
R^2	0.5718	0.6246	0.6276	0.6250	0.6798	0.6799	0.6826
Adjusted R^2	0.5682	0.6149	0.6146	0.6120	0.6658	0.6629	0.6658
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with environmental pillar scores are ranked from top to bottom by their average pillar score: the firms in the top third constitute the high-Environmental pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table H.3 Regression results for the monthly returns net risk-free rate for the low-Social pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0147****	**0.0153*****	**0.0168*****	**0.0182*****	**0.0147*****	**0.0160*****	**0.0174*****
	(2.4830)	(2.7361)	(2.7363)	(2.8887)	(2.6599)	(2.6985)	(2.7867)
Mrkt-Rf	**1.3090*****	**1.2635*****	**1.1952*****	**1.2514*****	**1.2353*****	**1.1850*****	**1.2373*****
	(6.3873)	(6.6770)	(7.1979)	(6.7961)	(6.3608)	(6.8201)	(6.6192)
SMB		**1.9231*****	**1.9182*****	**1.9782*****	**1.9630*****	**1.9849*****	**2.0695*****
		(3.3978)	(3.3889)	(3.5389)	(3.0332)	(3.0516)	(3.3119)
HML		**-0.6874***	**-0.8740****	**-0.7057****	**-0.7238****	**-0.9906****	**-0.8035****
		(-1.9256)	(-2.1630)	(-2.0121)	(-1.9840)	(-2.1893)	(-2.1594)
WML			-0.2868			-0.2822	
			(-1.1063)			(-1.0507)	
BAB				-0.3207			-0.3362
				(-0.9614)			(-0.9542)
RMW					0.1588	0.1615	0.2367
					(0.2226)	(0.2212)	(0.3412)
CMA					-0.3724	-0.1685	-0.2000
					(-0.5663)	(-0.2508)	(-0.2710)
R^2	0.3440	0.4849	0.4898	0.4896	0.4848	0.4892	0.4896
Adjusted R^2	0.3385	0.4716	0.4721	0.4719	0.4622	0.4621	0.4625
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with social pillar scores are ranked from top to bottom by their average pillar score: the firms in the bottom third constitute the low-Social pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table H.4 Regression results for the monthly returns net risk-free rate for the high-Social pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	0.0018	0.0006	0.0002	-0.0003	-0.0011	-0.0010	-0.0006
	(0.6897)	(0.2637)	(0.0737)	(-0.1108)	(-0.5409)	(-0.4500)	(-0.2232)
Mrkt-Rf	**0.7659*** **	**0.8044*** **	**0.8251*** **	**0.8083*** **	**0.8776*** **	**0.8720*** **	**0.8780*** **
	(11.2844)	(11.4743)	(10.8284)	(11.5464)	(13.8146)	(13.7040)	(13.8918)
SMB		**-0.7459*** **	**-0.7444*** **	**-0.7636*** **	**-0.4354*** **	**-0.4329*** **	**-0.4146** **
		(-4.9793)	(-4.9164)	(-4.9210)	(-2.7611)	(-2.7097)	(-2.4058)
HML		0.0150	0.0717	0.0209	-0.1200	-0.1498	-0.1355
		(0.1474)	(0.5729)	(0.2092)	(-0.8423)	(-0.7925)	(-0.8420)
WML			0.0871			-0.0316	
			(0.6641)			(-0.2544)	
BAB				0.1032			-0.0656
				(0.6756)			(-0.4197)
RMW					**0.6035** **	**0.6038** **	**0.6187** **
					(2.3736)	(2.3406)	(2.4202)
CMA					**0.8647*** **	**0.8875*** **	**0.8984*** **
					(4.2096)	(3.8426)	(3.7632)
R^2	0.5358	0.6068	0.6089	0.6091	0.6665	0.6668	0.6674
Adjusted R^2	0.5318	0.5967	0.5953	0.5955	0.6519	0.6491	0.6497
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with social pillar scores are ranked from top to bottom by their average pillar score: the firms in the top third constitute the high-Social pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table H.5 Regression results for the monthly returns net risk-free rate for the low-Governance pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0088****	**0.0089****	**0.0096****	**0.0108****	**0.0075****	**0.0082****	**0.0098****
	(2.3290)	(2.4199)	(2.3642)	(2.4042)	(2.2024)	(2.1741)	(2.3131)
Mrkt-Rf	**1.1116*****	**1.0956*****	**1.0637*****	**1.0876*****	**1.0778*****	**1.0521*****	**1.0795*****
	(8.5180)	(8.4202)	(8.6932)	(8.5699)	(8.3535)	(8.9474)	(8.7821)
SMB		**0.7358****	**0.7335****	**0.7725****	**0.9476*****	**0.9588*****	**1.0378*****
		(2.2547)	(2.2493)	(2.3654)	(2.7337)	(2.7481)	(2.9367)
HML		**-0.2802**	**-0.3673***	-0.2923	-0.1096	-0.2460	-0.1771
		(-1.5191)	(-1.7052)	(-1.5491)	(-0.4810)	(-0.8442)	(-0.6900)
WML			-0.1340			-0.1442	
			(-0.7060)			(-0.7193)	
BAB				-0.2136			-0.2847
				(-0.8957)			(-1.1814)
RMW					0.6657	0.6671	0.7318
					(1.4356)	(1.4045)	(1.5810)
CMA					-0.2602	-0.1560	-0.1142
					(-0.6530)	(-0.3586)	(-0.2539)
R^2	0.5224	0.5674	0.5697	0.5718	0.5820	0.5844	0.5892
Adjusted R^2	0.5184	0.5562	0.5547	0.5569	0.5637	0.5623	0.5674
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with governance pillar scores are ranked from top to bottom by their average pillar score: the firms in the bottom third constitute the low-Governance pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table H.6 Regression results for the monthly returns net risk-free rate for the high-Governance pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	0.0005	-0.0006	-0.0012	-0.0013	-0.0026	-0.0025	-0.0017
	(0.1837)	(-0.2306)	(-0.4503)	(-0.4233)	(-1.1685)	(-1.0888)	(-0.6028)
Mrkt-Rf	**0.8551*** **	**0.8921*** **	**0.9190*** **	**0.8951*** **	**0.9724*** **	**0.9693*** **	**0.9731*** **
	(11.3887)	(11.6556)	(11.2066)	(11.6358)	(14.2737)	(14.3651)	(14.5204)
SMB		**-0.7202*** **	**-0.7182*** **	**-0.7336*** **	**-0.3651** **	**-0.3638** **	**-0.3289***
		(-4.4190)	(-4.3491)	(-4.3502)	(-2.2123)	(-2.1746)	(-1.8164)
HML		0.0159	0.0893	0.0204	-0.1356	-0.1518	-0.1627
		(0.1468)	(0.6836)	(0.1902)	(-0.9092)	(-0.8239)	(-0.9784)
WML			0.1129			-0.0172	
			(0.8053)			(-0.1316)	
BAB				0.0786			-0.1144
				(0.5024)			(-0.7554)
RMW					**0.6942** **	**0.6944** **	**0.7208** **
					(2.3858)	(2.3650)	(2.4452)
CMA					**0.9460*** **	**0.9584*** **	**1.0047*** **
					(4.0765)	(3.8131)	(3.8607)
R^2	0.5591	0.6146	0.6175	0.6157	0.6783	0.6784	0.6804
Adjusted R^2	0.5554	0.6046	0.6042	0.6023	0.6642	0.6613	0.6634
Observations	120	120	120	120	120	120	120

*The table reports Fama-French five-factor model time-series regressions with Newey-West standard errors of monthly returns on the portfolios net risk-free rate over the period January 2011- December 2021 (120 months). The sample of sin stocks with governance pillar scores are ranked from top to bottom by their average pillar score: the firms in the top third constitute the high-Governance pillar portfolio. The portfolios are value-weighted. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Appendix I. Zero-net portfolios by pillar score

This appendix presents the regression results for the zero-net portfolios by their pillar score: Table I.1 presents the zero-net portfolio long the low-Environmental pillar portfolio, short the high-Environmental pillar portfolio; Table I.2 presents the zero-net portfolio long the low-Social pillar portfolio, short the high-Social pillar portfolio Table I.3; Regression results for the zero-net portfolio long the low-Governance pillar portfolio, short the high-Governance pillar portfolio.

In summary, all the tables show that there have been positive and highly significant alphas across all models. The evidence shows that sin stocks with low ESG scores have outperformed sin stocks with high ESG scores and confirm *Hypothesis 4*.

Table I.1 Regression results for the zero-net portfolio long the low-Environmental pillar portfolio, short the high-Environmental pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0120****	**0.0141*****	**0.0159*****	**0.0173*****	**0.0153*****	**0.0163*****	**0.0169*****
	(2.2111)	(2.9050)	(3.1757)	(3.4373)	(3.3131)	(3.4466)	(3.4367)
Mrkt-Rf	**0.3202****	**0.2375***	0.1553	**0.2242***	0.1441	0.1032	0.1453
	(2.0583)	(1.8108)	(1.2109)	(1.7022)	(1.1108)	(0.7943)	(1.1379)
SMB		**2.1096*****	**2.1038*****	**2.1702*****	**1.8425*****	**1.8603*****	**1.9065*****
		(4.6144)	(4.6054)	(4.8243)	(3.4388)	(3.4538)	(3.6696)
HML		-0.3583	**-0.5826***	-0.3783	-0.2321	-0.4489	-0.2800
		(-1.2115)	(-1.7387)	(-1.2947)	(-0.8902)	(-1.4469)	(-1.1291)
WML			**-0.3450***			-0.2293	
			(-1.9793)			(-1.3327)	
BAB				-0.3524			-0.2020
				(-1.4949)			(-0.8219)
RMW					-0.4319	-0.4297	-0.3851
					(-0.7791)	(-0.7663)	(-0.7089)
CMA					**-1.1366****	**-0.9709***	**-1.0330***
					(-2.1986)	(-1.9292)	(-1.8445)
R^2	0.0386	0.2924	0.3058	0.3032	0.3121	0.3176	0.3154
Adjusted R^2	0.0305	0.2741	0.2816	0.2790	0.2820	0.2813	0.2790
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on the portfolio net risk-free rate over the period January 2011- December 2021 (120 months). The zero-net portfolio is long the low-Environmental pillar portfolio and short the high-Environmental pillar portfolio. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table I.2 Regression results for the zero-net portfolio long the low-Social pillar portfolio, short the high-Social pillar portfolio

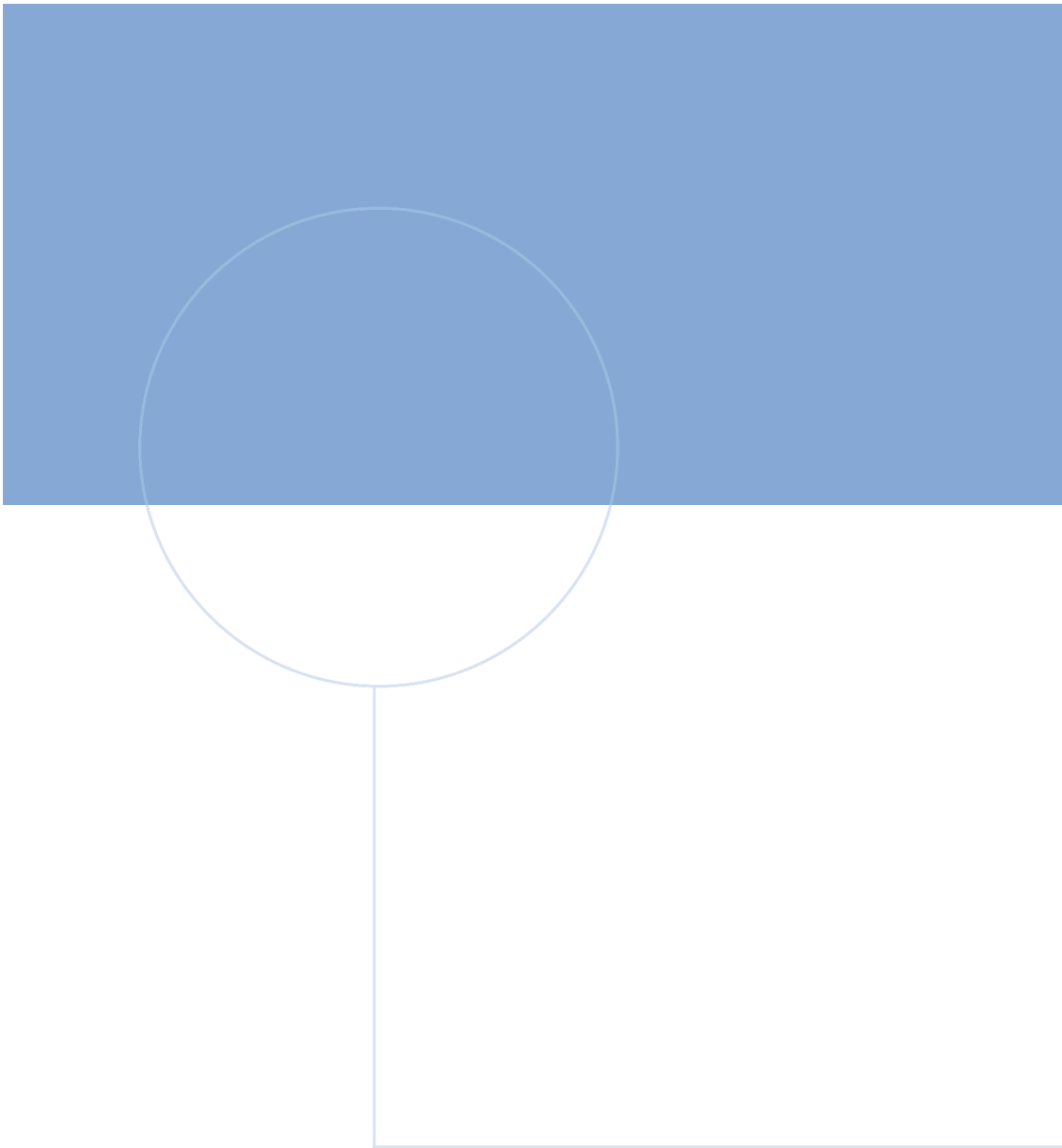
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0130***	**0.0147****	**0.0166*****	**0.0185*****	**0.0158*****	**0.0169*****	**0.0180*****
	(1.9796)	(2.5261)	(2.7082)	(2.9944)	(2.7431)	(2.8500)	(2.8989)
Mrkt-Rf	**0.5431*****	**0.4591*****	**0.3701****	**0.4431*****	**0.3577****	**0.3130***	**0.3593****
	(2.6648)	(2.6460)	(2.3102)	(2.6286)	(2.0195)	(1.8793)	(2.0957)
SMB		**2.6690*****	**2.6626*****	**2.7418*****	**2.3984*****	**2.4178*****	**2.4841*****
		(4.7971)	(4.7733)	(5.0268)	(3.6836)	(3.6927)	(4.0203)
HML		**-0.7025***	**-0.9456****	**-0.7266****	**-0.6038***	**-0.8407****	**-0.6679***
		(-1.9061)	(-2.2989)	(-2.0109)	(-1.7163)	(-2.0117)	(-1.9539)
WML			-0.3739*			-0.2506	
			(-1.6693)			(-1.1189)	
BAB				-0.4239			-0.2706
				(-1.4162)			(-0.8599)
RMW					-0.4447	-0.4423	-0.3820
					(-0.6713)	(-0.6596)	(-0.6007)
CMA					**-1.2371***	-1.0560	-1.0983
					(-1.8629)	(-1.6017)	(-1.5114)
R^2	0.0712	0.3588	0.3689	0.3689	0.3722	0.3763	0.3759
Adjusted R^2	0.0634	0.3423	0.3470	0.3469	0.3446	0.3432	0.3427
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on the portfolio net risk-free rate over the period January 2011- December 2021 (120 months). The zero-net portfolio is long the low-Social pillar portfolio and short the high-Social pillar portfolio. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*

Table I.3 Regression results for the zero-net portfolio long the low-Governance pillar portfolio, short the high-Governance pillar portfolio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alpha	**0.0082****	**0.0095*****	**0.0108*****	**0.0122*****	**0.0101*****	**0.0107*****	**0.0115*****
	(2.0879)	(2.6802)	(2.9135)	(3.1170)	(3.0229)	(3.0535)	(3.1290)
Mrkt-Rf	**0.2565****	**0.2035***	0.1447	**0.1925***	0.1054	0.0827	0.1064
	(2.1881)	(1.9113)	(1.4423)	(1.8588)	(1.0197)	(0.8325)	(1.0627)
SMB		**1.4559*****	**1.4517*****	**1.5061*****	**1.3127*****	**1.3225*****	**1.3667*****
		(4.7764)	(4.7456)	(5.0252)	(3.9125)	(3.9192)	(4.1742)
HML		**-0.2961***	**-0.4567****	**-0.3127***	0.0260	-0.0941	-0.0144
		(-1.6867)	(-2.1953)	(-1.7411)	(0.1346)	(-0.4057)	(-0.0745)
WML			**-0.2469***			-0.1271	
			(-1.6923)			(-0.8988)	
BAB				-0.2921			-0.1703
				(-1.6416)			(-0.9997)
RMW					-0.0285	-0.0273	0.0110
					(-0.0798)	(-0.0754)	(0.0312)
CMA					**-1.2063*****	**-1.1144*****	**-1.1189*****
					(-3.2369)	(-2.9338)	(-2.8451)
R^2	0.0506	0.3053	0.3193	0.3204	0.3478	0.3512	0.3525
Adjusted R^2	0.0426	0.2873	0.2956	0.2968	0.3192	0.3168	0.3182
Observations	120	120	120	120	120	120	120

*The table reports time-series regressions with Newey-West standard errors of monthly returns on the portfolio net risk-free rate over the period January 2011- December 2021 (120 months). The zero-net portfolio is long the low-Governance pillar portfolio and short the high-Governance pillar portfolio. T-scores are shown in parentheses. Bold denotes significance. ***, ** and * indicate 1%, 5%, and 10% significance. Alpha is the monthly abnormal return; Mrkt-Rf is the market return net the risk-free rate; SMB is the Small-Minus-Big factor; HML is the High-Minus-Low factor; WML is the Momentum factor; BAB is the Betting-Against-Beta factor; RMW is the Robust-Minus-Low factor; CMA is the Conservative-Minus-Aggressive factor. (1) is the CAPM model; (2) is the Fama-French three-factor model; (3) is the Carhart four-factor model; (4) is the Fama-French three-factor model with Betting-Against-Beta; (5) is the Fama-French five-factor model; (6) is the Fama-French five-factor model with Momentum; (7) is the Fama-French five-factor model with Betting-Against-Beta.*



NTNU

Kunnskap for en bedre verden