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# Does ESG rating affect sin stock performance? Evidence from sin stocks in US markets

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## Abstract

Sin stocks and ESG are two sides of a story that has received extensive attention separately, but not many researchers have looked at the possibility to connect the two. Previous research show puzzling evidence about a sin stock anomaly that has been known for years, and positive CFP associated with CSP. Our research will step into the research area where we look at both ESG and sin stocks connected. This thesis will investigate the relationship between ESG-scores and sin stocks, by looking at publicly traded companies in the US During 2002-2019.

In this paper we will present new evidence on how sin stocks outperform the rest of the stock market. Previous research papers have proven the abnormal return to be true, but not accounted for the ESG Scores. When using ESG Scores as a criterion to form our various sin stock portfolios, we found that sin stocks with a bad ESG Score, or with no ESG Score, outperformed sin stocks with a good ESG Score.

## Acknowledgements

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We would also like to thank BI for their ability to quickly adapt to the new restrictions from the government after COVID-19 hit Norway and still be able to take good care of the students. The Library especially has shown patience and willingness to help us retrieve the data needed when the school was shut down.

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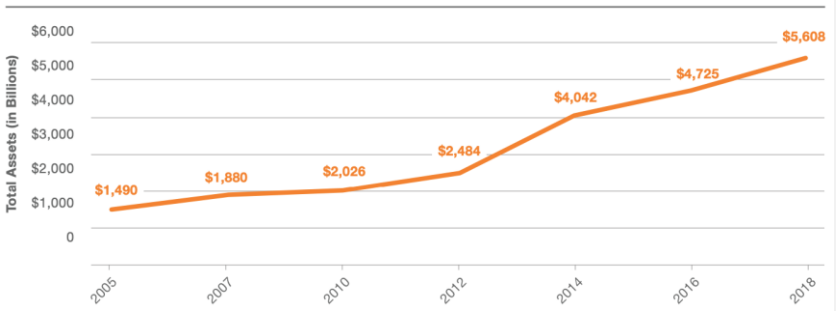
## 1.0 Introduction

Shares in companies involved in activities that are considered unethical, are often referred to as "sin stocks," but also as "vice stocks," "shunned stocks," "controversial stocks" and "unethical stocks." Nonetheless, they all commonly refer to companies that exploit human weaknesses and vices, in order to generate revenue. Various studies show that sin stocks deliver historical positive abnormal returns (fabozzi et al., 2008; Hong & Kacperczyk, 2009; Kim and Venkatachalam, 2011). Despite these findings, many investors are neglecting sin stocks in their portfolios to not be associated with their controversial activities. But are sin stocks as "bad" as their reputation proclaim?

**Commented [OM1]:** Kanskje prøve å referere til en artikkel eller kilde som snakker om hvor fæle SIN stocks er?

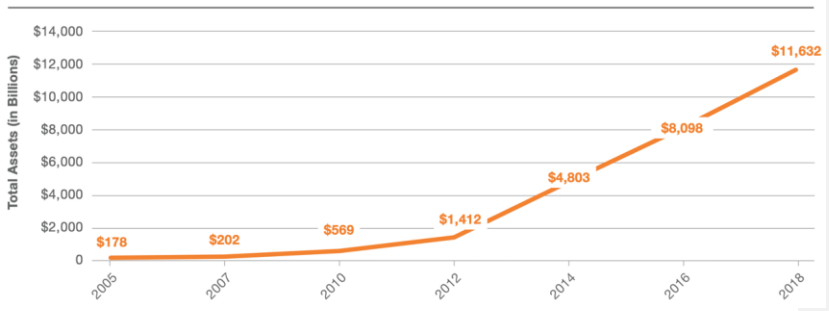
On the other side of the investment environment, socially responsible investing (SRI) and Environmental, social and governance (ESG) has become increasingly trending over the last decade. As shown in in figure 1 and 2, ESG has shown a tremendous growth for both Institutional investors and money managers. Institutional investor in particular, are relevant explaining the sin stock anomaly.

***Figure 1: Growth of ESG Incorporation Reported by Institutional Investor 2005-2018***




***Source: US SIF Foundation 2018***

***Figure 2: growth of ESG Incorporated reported by Money Managers 2005-2018***




***Source: US SIF Foundation 2018***

SRI is defined as an investment process, where the goal is to identify companies with the best profiles regarding corporate social responsibility (CSR) (see Renneborg, Ter Horst and Zhang, 2008a). If investors are meant to act socially responsible, they must find a way to quantify corporate CSR into a measurable variable to separate good CSR companies from bad CSR companies. ESG-score is the leading indicator in doing this, and to show how well the company is doing in terms of sustainability. Both measures of environmental and social are included in CSR, ESG, on the other hand, also includes a governance performance measure in addition to the previous two.

As indicated earlier, there has been a rapid shift towards SRI strategies and ESG incorporation over the recent years. According to the report on US Sustainable, Responsible and Impact Trend, SRI had about $2,34 trillion dollars of the total Assets Under Management (AUM) in 2001 and in 2018 the number was $12 trillion dollar. Since the beginning of SRI in 1995, the annual compounded growth rate of SRI has been 13,6 percent until 2018. Total amount of AUM by professionals in 2018 was $46,6 trillion dollar, that means about 26 percent of the total AUM, an increase from 12 percent of AUM in 2001. The reason why we should care about this staggering trend in the financial markets is the fact that many sin stocks are being neglected in the SRI process. Understanding the relationship between ESG and sin stock performance, might be a way to improve the financial markets and the portfolios of investors.

There are two different types of socially responsible investors that Derwall et al. (2011) addresses. “Value-Driven Investors” (VDI) and “Responsible Profit Seekers” (RPS). VDI are mainly concerned about the non-financial utility they derive from high ESG ratings from their investments. Similarly, RPS wish to concentrate on high ESG-rated companies, but they are more concerned about their financial return from their portfolio choices, and they are not willing to sacrifice the financial return for non-financial utility. There is also a third type of investor, “irresponsible profit seeker” (IPS). IPS are not concerned about ESG and is willing to invest in controversial stocks if they yield superior returns. With the segmentation of the different types of investors, there is evidence that could explain the puzzling evidence that both socially responsible and sin stocks produce abnormal returns. VDI are primarily using negative screening, while RPS is using positive screening. The impact of different SRI strategies is further discussed in the literature review, and the theory related to the different types of investors will be explained in the theory part of this thesis.

There are over 2200 empirical studies that have examined the relationship between Corporate Financial Performance (CFP) and ESG criteria, as a proxy for Corporate Social Performance (CSP) (Friede et al., 2015; Drempetic et al.,2019) are one who criticized the data from sustainability rating agencies, and what they measure with their ESG score. The paper suggests that the information to conduct analysis from researchers and sustainable and responsible investors are not provided for with ESG scores.

The ESG scores used in this research paper are covered by Refinitiv and there are three potential problems that arise from the imperfect (and increasing over time) coverage of companies in Refinitiv. The three problems are about ESG and firm size, the possibility that having an ESG score at all indicates better ESG performance and an issue regarding whether good ESG score reflect good ESG performance, or just good ESG reporting. All of these issues will be discussed in detail in section 7.1.1 - 7.1.3.

In this paper, we aim to extend previously conducted research on SIN-stock performance. This will be done by building upon previous SIN stock anomaly studies such as (Hong & Kacperczyk, 2009; Blitz and fabozzi, 2017). The same framework will be utilized, but will be expanded upon, by incorporating ESG Scores into our portfolios. We provide empirical evidence that the sin stock anomaly do exists from publicly traded companies involved in in production of alcohol, tobacco, gambling and weapons listed in three different stock exchanges in the US. The stock exchanges are NASADQ, Amex and NYSE, all with monthly data during 2002-2019.

This paper will start with how we arrived at the research question in part one, then present some of the most relevant literature and theories on the subject in part two and three. We will provide the necessary hypotheses to answer our research question under part four. Methodology and data will be provided in in part five, before we take on validity under part six. Statistics will be shown under part seven and results and analysis in part eight. The ninth and final part will be used to conclude and raise discussion.

### 1.1 Research Question and objective of the thesis

As mentioned in the introduction, there has been a vast shift towards SRI in recent years, simultaneously as researchers provide evidence of an sin stock anomaly in controversial stocks. To better understand potential limitations and potential rewards for investors investment decisions with regard to social norms, ESG and sin stocks, research on both ESG and sin stocks could address and maybe solve important issues that might evolve over time. We find this line of thought intriguing, and based on the findings stated in the introduction we will try to answer the following question.

*How does ESG Score affect US sin stock performance?*

As stated, several studies conclude that SIN stocks provide abnormal returns and are systematically underpriced, due to their controversy. The few scientific papers from 2015 and onwards, that incorporated more recent factor-models, have on the other hand, attained more mixed results. By following Hong and Kacperczyk,

(2009), The background for several researchers to examine sin stock performance, are the phenomena that sin stocks to be neglected by norm-constrained investors due to social norms, institutional investors and litigation risk. In this paper, we want to bring another dimension into the research, by including ESG scores in our portfolio. We will deconstruct our research question into six hypothesis that aims to capture several aspects between sin stock returns and ESG scores.

## 2.0 Literature review

A wide array of research is related to social responsible investments, but the research dedicated to sinful investing remain scarce both in quantity and theoretical relevance. Even less research has been done looking at how these two investment strategies might be connected and what drives both sin stock performance and ESG. By "connected", we mean if ESG-scores might provide more information about sin stocks and their performance, or serve a different purpose other than tell us how companies perform under the three categories: environmental, social and governance.

Moskowitz (1972) was the first person to look at the relationship between Corporation's social responsibility and its financial performance. He took a sample consisting of 14 companies he found to be socially responsible and showed that the stocks outperformed the S&P500 and Dow Jones and started a positive association between CSR and stock returns.

Since Moskowitch, several ESG studies has been conducted. In order to get a more general view about ESG and corporate financial performance, Friede et al. (2015) is great place to start. They examined approximately 2000 empirical studies and about 200 review studies, including both primary and secondary data from the previous academic review studies. Due to the overwhelmingly broad data collection, the authors are allowed to make generalized statements. About 90 percent of the studies find a non-negative relationship between ESG and corporate financial performance. Even more important, the majority of those studies report positive findings, as well as a stable positive trend over time. Nevertheless, when they separated portfolio studies (about 150 studies in 2015 and back in time) from

non-portfolio studies, they found on average a neutral/mixed ESG - corporate financial performance relation. Even though there is hard evidence in favor of the positive relationship, there will still be different aspects of ESG other than financial performance to consider when looking at sin stock performance.

One interesting aspect of ESG is made by Renneborg, Ter Horst and Zhang (2011). They studied the money flows into and out of SRI funds around the world. Investors in SRI funds may be more concerned about social or ethical issues than pure financial returns. For ethical reasons, SRI funds tend to use negative screens (excluding sin stocks and controversial stocks), and hence, receive larger money inflows. These SRI funds are also less sensitive to past weak performance, compared to other SRI funds. These results suggest that sin stock screens that serve social investors non-pecuniary demands, are also making social investors willing to accept a financial loss in exchange for non-pecuniary utility. This interpretation is backed up by research that focus on the holdings by institutional investors, which is a significant stepping stone in many sin stock studies. Statman and Glushkov (2009), further support the potential consequences that negative screening may have, and provides evidence that the return on SRI is higher than conventional investors, but equals disadvantage when accounting for negative screening.

Using survey data from “mainstream” senior investment professionals, excluding SRI funds, Amel-Zadeh and Serafeim (2018) provided insight in why and how these investors apply ESG information. When making investments decisions, respondents considered ESG information financially material to investment performance. ESG information was also viewed as a good tool for looking at risk rather than the company’s competitive position. The most frequent use of ESG information is to screen companies, and the most used method is negative screening, even though it is considered the least investment beneficial. The two most beneficial viewed methods are positive screening and a full integration of ESG information into stock valuation. In the future, respondents expected a higher use of positive screening and a decrease in the use of negative screening.

Lins, Servaes and Tamayo (2016) investigated the connection between social capital, trust and firm performance during the financial crisis. They find evidence that suggest the trust between a company, its stakeholders and its investors, build through investments in social capital, increases the performance of the company when the overall trust in companies and the market suffer from a negative shock. If these findings hold, one could expect this to impact our results around 2008's financial crisis, but not be significant enough to impact the results in the whole sample period.

As a consequence of ESG information being a subset of non-financial reporting, and not to follow a standardized format, ESG disclosure exhibits significant variations elzahar, Hussainey, Mazzi & Tsakavoutas, (2015). Previous research suggest that ESG disclosure is showing variations that differ across companies and countries due to management's ability entailing discretion when choosing content and format Reverte, 2009; Ioannou & Serafeim, (2014). Furthermore Durren, Plantinga & Scholtens (2016) provide evidence that that ESG is viewed in substantially different ways between US and European asset managers. They state that US managers are much less opportunistic about SRI concerning financial performance, but also share the same view regarding the impact that SRI might have on the investment process. They also conclude that the idea of fundamental investing and SRI being close to each other is more common in Europe. These potential variations in countries and companies should be kept in mind when only looking at ESG data from one specific country like the US.

On the sin side of investments, The Price of Sin, written by Hong and Kacperczyk, published in 2009, are viewed as the most comprehensive work on sin stocks today. By hypothesising that sin stocks are subject to societal norms, they were interested in publicly traded companies that operate and contribute to sinful industries. They found that institutional investor avoid sin stocks in their investments portfolios by looking at the ownership structure in sin stocks. On the contrary, natural arbitrageurs, like mutual funds, hedge funds and independent investment advisors, exhibits normal levels in sin stocks' capital structures. By abstaining from sin stocks, institutional investors subject to social norms, pays a higher financial cost. Sin stocks also receive less coverage from analysts, yield

higher expected returns, face higher litigation risk and they are generally considered undervalued compared to stocks with similar characteristics.

Hong and Kacperczyk measured the performance of sin stocks including the triumvirate of sin in the US and 21 different countries during the time period 1965-2006, promoting three important results. In the first result, by looking at time-series regressions, sin stocks outperformed their comparables by 26 basis points a month after controlling for Fama and French's three-factor model and Carhart's four-factor model. In the second result, sin stocks also outperformed their comparables by 29 basis points a month after controlling for firm characteristics using cross-sectional regressions. The third result showed that by comparing valuation ratios, they found that the valuation ratios of sin stocks was on average 15 to 20 percent lower than their comparables, after controlling for differences in other stocks characteristics. All three results were economically and statistically significant. To validate their results for robustness purposes they did several modifications, most noteworthy, they extended the sample period back to 1926 and redid their analysis including weapon stocks. The new results became qualitatively similar to the original results.

Fabozzi, Ma & Opliphant (2008) are one of many who support the findings of Hong & Kacperczyk (2009) by using a sample of 21 different countries during 1970-2007. The equal weighted portfolio included in excess of the triumvirate of sin, industries like defense, biotech and pornography. The sin portfolio produced an annual return of 19 percent and outperformed common benchmarks both in magnitude and frequency.

In contrast to Hong and Kacperczyk (2009), Blitz and Fabozzi (2017) finds no significantly abnormal returns after extending the Fama and french three-factor model and Carharts Four-factor model with two more factors. The factors are known as investment (CMA) and profitability (RMW), introduced by Fama and French (2015). Sin stocks tend to be low-beta stocks, and to further support their findings, they also extended the regression with a Betting against Beta (BAB) factor, introduced by Frazzini and Pedersen (2014). Even though BAB showed significant explanatory power in many of the regressions, CMA and RMW

completely negates the abnormal returns in all regressions. If these results hold, investors who exclude sin stocks may invest more in stocks that will compensate for the lost factor exposure, in order to gain the same expected returns.

Furthermore, Adamsson and Hoepner (2015), criticized the research design of Hong and Kacperczyk (2009). They reexamined whether the sin stock premium attained from sin stocks are investable for real world investor. To investigate their hypothesis, they limited their analysis to stocks in the global equity index benchmark of institutional investors. Thousands of stocks usually considered too illiquid in practice were eliminated. Their results showed sin premiums in the equal weighted sin-industry portfolios. However, the authors claimed that these equal-weighted sub-industry portfolios are not investable for a majority institutional investors, due to their value-weighted benchmarks. Assuming that small cap firms outperforms large cap firms in the Fama-French models, one could expect the equal weighted portfolio to outperform the value weighted portfolio and a value-weighted market portfolio. When value-weighting the sin portfolios, the premium for the gambling industry disappears. Within all industry sectors, The Fama-French model controls for differences in return between small cap firms and large cap firms. What the model does not control for is differences in return between small cap firms and large cap firms in a single sector, such as consumer goods, and consumer goods may drive the return of sub-industries in the sector like alcohol and tobacco. By applying a within sector control variable to their model, sin premium disappears for all industries both at the global level and in the US. The authors explain their findings by a small cap bias. We will proceed with equal-weighted portfolios like many other researchers. To make a within sector control variable and use value weighted portfolios will not be our primary focus, that might be something to address for future research. The author might make some solid arguments, nevertheless, the paper has received very little attention and citations compared to Hong and kacperczyk (2009), who swear to the equal weighted portfolio.

Lobe and Walkshäusl (2016) investigated global, regional and domestic portfolios composed of sin stocks and measured them against portfolios composed of socially responsible stocks. In contrast to previous studies they found no evidence

of sin stocks underperforming or overperforming. Blitz and Fabozzi (2017) criticized the study and raised questions regarding their portfolio composition, which included 46 percent allocation to nuclear power. In their study Nuclear power has a much lower CAPM alpha compared to the triumvirate of sin, including weapons. Their study also included 755 sin stocks while the majority of studies use samples with about 100 sin stocks. This might be because they used slack sector definitions or included microcaps.

There are two important studies that link CSR directly to Sinful industries. In the first, Cai, Jo & Pan (2012) examines the empirical association between CSR engagement for sinful firms and firm value. Using a vast set of sinful industries including the triumvirate of sin, but also weapon, oil, cement and biotech, they tested three different hypothesis in a US sample during 1995-2009, and found evidence that CSR engagement of sinful firms positively affect firm value. Furthermore, in the second study, Jo & Na (2012) examines the relationship between firm risk and CSR in sinful industries. Using a US sample during 1991-2010 with the same set of sinful industries as Cai, Jo & Pan (2012), finds evidence that CSR engagement inversely affects firm risk. In addition, they find evidence that the risk reduction of CSR engagement in sinful firms are both economically and statistically more significant than for non-sinful firms. This supports the premise that firm risk is a bigger issue for sinful firms.

Both studies did control for various firms characteristics to further support their results. The mentioned connections between CSR and sinful firms, might give deeper insight and understanding of the linking between ESG scores and Sin stock performance since CSR and ESG are much of the same.

Auer and Schumacher (2016) measured the performance of socially (ir)responsible investments in US, Europe and the Asia-Pasific region during the sample period 2004-2012. By creating portfolios reflecting high ESG-rated companies and low ESG-rated companies, they measured the performance to common benchmarks at cut off rates of 5, 10 and up to 25 percent. They concluded that regardless of geographic region, industry or ESG criterion, active selection of high- or low-rated stocks does not beat the passive stock market on a

risk-adjusted basis. In US and the Asia specific region they also concluded that ethical investors can obtain a result similar to the broad market with an ESG-based investment style. In Europe, on the other hand, investors tend to pay a financial cost for social responsible investing. Even though Auer and Schumacher separated their analysis by looking at different broad industries, they did not specify anything about sin stocks, and how high or low ESG-ratings might affect their performance compared to the market.

## 3.0 Theoretical framework

A substantial amount of economic theories like EMH and arbitrage pricing theory could serve as foundation to our thesis, nevertheless, there are two theories heavily linked to each other that we find the most relevant to explain sin stock performance with our ESG approach. The theories are social norms and the shunned-stock hypothesis. Social norms is important to properly define, in order to understand some of the mechanisms behind sin stocks and ESG rating. The shunned-stock hypothesis comes from Derwall et al. (2011), and are useful to better understand what type of investors and investment methods that might orchestrate some of the mechanisms behind the sin stock performance in our ESG-related analysis of sin stocks.

### 4.1 Social Norms

When investigating a phenomenon that may exist due to social norms, a definition of social norms and a framework to explain the effect on economic behavior is in place. Similar to other researchers on the subject, we adhere to the work of Akerlof (1980). The work of Akerlof builds on the early articulation of Becker's (1957) model of discrimination, and the work of Arrow (1972). By following Akerlof (1980) we define a social norm or a custom, in line with Hong and Kacperczyk (2009), as an act whose utility to the agent performing it depends in some way on the beliefs or actions of other members of the community. Becker's model of discrimination shows that agents (e.g., employers) who exhibits discriminatory tastes arising from the community norms, pay for those tastes by bearing financial costs. Under our framework, that would be reflected as investors abstaining from sin stocks that might serve as good investment opportunities.

Extending upon Becker's model, Arrow shows that some agents that did not reveal discriminatory tastes could not profit from breaking the norms because of the loss of reputation and the subsequent costs. In our case, this would mean that investors who are indifferent whether a stock is sin or not, still are unable to invest due to the loss of reputation and subsequent costs. Arkelof also provides conditions that embodies the persistence of social norms, despite potential financial gain through disobedience. In other words, as long as the cost of reputation loss is sufficiently high related to the potential financial gain, the social norm will remain.

### 4.2 The shunned-stock hypothesis

The shunned-stock hypothesis assumes that socially responsible investors set up their asset allocation based on factors unrelated to pure financial performance. As mentioned in the introduction, these investors are referred to as VDI. The theory states that when the investors care about the non-pecuniary aspects of their investments, Demand will increase for responsible assets and/or decrease for irresponsible assets, as a result the behavior of stock prices might change. There are two important assumptions supporting this theory.

1. The first assumption is that social investors are VDI.
2. The second assumption assumes that VDI are substantial enough in numbers to affect security prices

For the first assumption, it is a challenge to quantify the breadth and different motivations behind investors trades. There are plenty of pecuniary reasons that might be true for the investors. For the second assumption, Kraus and Zechner (2001) says about 10 percent of the financial market should consist of investors that engage in SRI without financial payoff as the main motive, using their "Green" investment model. From the introduction one could argue there are anectodical evidence supporting that VDI has become more substantial over time due to the increased share of SRI investors in the market. From the literature review, negative screening was found to the most common SRI strategy Amel-

Zadeh and Serafeim (2018), hence one could expect the second assumption to hold.

The origin of the shunned-stock hypothesis can trace its origin back to the work of Merton (1987) and his incomplete information model and related literatures on segmented capital markets. The logic behind Merton (1987) is that information asymmetry caused by investor that are unaware of the stock, results in market segmentation, and the stock becomes undervalued due to smaller investor base, which again implies limited risk sharing. Following the same logic, the theory could also explain why sin stocks that are in conflict with social norms, being shunned by institutional investor because of the vulnerability to public opinion are, ceteris paribus, relatively cheaper and yield higher expected return Hong and Kacperczyk (2009). Angel and Rivoli (1997) predict that a controversial stock that is shunned by institutional investors has a higher expected return, but also that the expected return increase with the proportion of socially responsible investors in the market.

## 4.0 Hypothesis

With the relevant previous literature and theoretical framework in place, we will return to the research question: How does ESG-ratings affect sin stock performance? We deconstruct the main research question into six different hypothesis that will serve as a framework for six subsequent portfolios.

### 4.1 Hypothesis 1

Question: Do the sin stock portfolio* outperform comparable portfolios**?

**H0:** The sin stock portfolio does not outperform comparable portfolios.
**HA:** The sin stock portfolio does outperform comparable portfolios.
**Portfolio contains all 95 sin stocks identified in the CRSP market data.*
***Comparable portfolios are "Saint" portfolio and "Market" portfolio.*

### 4.2 Hypothesis H2

Question: Does the sin stock portfolio with ESG scores* outperform comparable portfolios**?

**$H_0$:** Sin stocks with an ESG score do not outperform comparable portfolios

**$H_A$:** Sin stocks with an ESG score do outperform comparable portfolios

***A total of 55 sin companies had an ESG Score available. See table in **Appendix D** for distribution.*

*** Comparable portfolios are "Saint" portfolio and "Market" portfolio.*

### 4.3 Hypothesis H3

Question: Does the sin stock portfolio with good ESG Scores* outperform comparable portfolios**?

**$H_0$:** The portfolio of sin stocks with good ESG Scores does not outperform comparable portfolios.

**$H_A$:** The portfolio of sin stocks with good ESG Scores does outperform comparable portfolios.

**Sin companies with an ESG Score above or equal to the median of 36,39 are considered to have a good ESG Score. See table in* **Appendix D** *for distribution.*

*** Comparable portfolios are "Sin with bad ESG Score", "Saint" portfolio and "Market" portfolio.*

### 4.4 Hypothesis H4

Question: Does the Saint portfolio* outperform comparable portfolios**?

**H0:** The Saint portfolio does not outperform comparable portfolios.

**HA:** The Saint portfolio does outperform comparable portfolios.

** The Saint portfolio is equal to the market portfolio, but all sin stocks are excluded.*

*** Comparable portfolios are all of the sin portfolios and "Market portfolio."*

### 4.5 Hypothesis H5

Question: Does the market portfolio* outperform comparable portfolios**?

**H0:** The market portfolio does not outperform comparable portfolios.

**HA:** The market portfolio does outperform comparable portfolios.

**Consists of all stocks trading on NYSE, NASDAQ and AMEX throughout our time period.*

*** Comparable portfolios are all of the sin portfolios and "Saint portfolio."*

## 5.0 Methodology and data

This chapter will present the complete set of data and the methodology used in our analysis. The chapter is divided into four sections which will provide a clear overview on how we proceeded in order to answer our research question. Section one revolves around our datasets and data collection. The second section summarizes the various constraints used to define our sin stock and comparable stock portfolios. Section three clarifies the regression models we applied and the fourth section discusses issues related to data validity.

Our methodology is partly a replication and expansion of the framework used by Hong & Kacperczyk in their highly accredited paper.
In order to measure how ESG Scores affect the performance of US sin stocks, we replicate and expand upon one of the most accredited sin stock research papers, conducted by Hong & Kacperczyk (2009).

### 6.1 Historical market data

Our data set consists of historical market data on US companies registered on NASDAQ, AMEX and NYSE. The selected time-period is from January 2002 – December 2019 and is updated with monthly intervals in order to secure robust and reliable results.
All the stock-data is fetched from The Center for Research in Security Prices, hereby referred to as CRSP, via the Warthon Research Data Services, hereby WRDS. Our data set contains a total of 355.045 datapoints, where 3.986 unique companies have been identified. These have been identified using the unique company level identifier PERMCO. This is a permanent identifier which remains unchanged throughout the whole term of a firms existence.

After reviewing the data, 182 duplicate values were identified. Furthermore, 7.961 rows of data were missing price and/ or return data.

The data is constructed as an unbalanced panel data set. The main advantage of structuring the data in this manner, is that unobservable variables across companies and years can be controlled for, with the prerequisite that we model our data accurately (Stock & Watson, 2015). Additionally, panel data contains more information than standard time-series data, which increased the reliability of our regressions.

All Fama and French factors are retrieved from Kenneth R French's online library. The data is formatted in percentage form, so in order to get the same format in the data set, we had to multipliy all the data in CRSP with 100. By doing this our regressions will show alfa in the intercept in percentage form. The BAB data was retrieved from AQR (kilde).

### 6.2 Refinitiv ESG Scores

Several rating agencies, such as Bloomberg, Sustainalytics, Refinitiv and MSCI, provide highly accredited ESG Scores for corporations. Hence, it can be challenging to decide which ESG Score-provider to use. Particularly since there is no streamlined methodology of assigning ESG Scores. The recent paper "Rating the raters: Evaluating how ESG rating agencies integrate sustainability principles", by Escrig-Olmedo, E., Fernández-Izquierdo, M. Á., Ferrero-Ferrero, I., Rivera-Lirio, J. M., & Muñoz-Torres, M. J. (2019), investigates this issue. They investigated the top agencies and found that, only two of them incorporated all four of the UN Sustainable Development Goals (SDGs), which is considered guidelines that all rating agencies should incorporate. These two agencies were MSCI and Refinitiv. Refinitiv are also highly transparent on their methodology and rating criteria. These are the main reasons why we decided to proceed with the Refinitiv ESG Scores.

The Refinitiv ESG Scores were obtained through Thomson Reuters Datastream. The ESG scores dates back to 2002, which is why our time-period starts at this

point in time. The scores range from 0 to 100 and is calculated using 400 different measures. These measures are collected from annual reports, company websites, NGO websites, stock exchange filings, CSR repors and News Sources (Refinitiv, 2020).

The remaining data needed after integrating the ESG scores with the historical market data, is the various research factors.

### 6.3 Research Factors

We run three types of regressions, which is explained in chapter 6.6. In order to run Our regressions we need to retrieve the necessary research factors. These consists of Carhart's momentum factor and the Fama and French 3- and 5-factors, which is obtained through the Kenneth French Data Library. Additionally, we need the BAB-factor, which is downloaded through the AQR website.

### 6.4 Selection of sin stocks

The first objective in the sampling procedure is to identify a sample of sin stocks. Since there is no formal definition of sin stocks, we will like many other Follow the methodology from Hong and Kacperczyk (2009). The data for our analysis will include companies registered in the US, from the industries known as the "Triumvirate of Sin", namely alcohol, tobacco and gambling. These are the industries that are associated with abnormal returns from previous studies. The weapon industry will also be included, but industries like porn, marijuana, biotech and nuclear power are not included in this study. The porn, marijuana, biotech and nuclear industries are only used in a minority of the studies as shown in **Appendix A.** In order to get a sufficient sample size with ESG scores, the weapon industry was included to do this. There are Americans who do not consider the weapon industry as sinful, nevertheless it is included in a fair amount of studies, also shown in Appendix A. The weapon industry is highly controversial for a majority of SRI investors and has been affected similarly as the triumvirate of SIN stocks.

### 6.5 Classification procedure

Following Hong and Kacperczyk (2009), we use the Fama and French (1997) classification, to classify the industries into sin portfolios and non-sin portfolios. There are in total 49 classifications, and the companies are separated into different groups by their Standard Industrial Classification (SIC) codes. Beer and alcohol stocks have SIC codes ranging from 2100-2199 in the fourth industry group, named "beer". Tobacco is ranging from 2080-2085 in the fifth industry group, named "smoke". For the gambling[1] industry, the Fama and French system will not be precise enough, because gambling is only included in the hoteland entertainment industry classification. The most common way to handle this problem is to use the North American Industry Classification System (NAICS). Gambling stocks are found in code 7132, 71312, 713210, 71329, 713290, 72112 and 721120. Additionally, we used classification 5181 (establishments primarily engaged in the wholesale distribution of beer, ale, porter, and other fermented beverages), 5194 (Establishments primarily engaged in the wholesale distribution of tobacco and tobacco products) and 5159 (Establishments primarily engaged in buying and/or marketing farm products, not elsewhere classified). 5159 are far too wide to use, hence we only use SIC code 5159 with duplicate NIACS code 424590 (leaf tobacco merchant wholesalers). we also have done our own online research to identify sin stocks to compare with our samples. Sinstockreport.com has been very helpful here.

[1] Hong and kacperczyk (2009) refers to the "gaming" industry, because of the confusion this might cause, due to gaming as a part of e-sports etc., we find it easier to rename it to "gambling."

***Table 1. List of Industry codes for different Sin groups***

| SIN Industries | SIC | NAICS |
|---|---|---|
| Alcohol | 2080-2085, 5181 | 325193, 4248, 42481, 424810, 42482, 424820, 7224, 72241, 722410 |
| Tobacco | 2100-2199, 5194, 5159 | 424940, 453991, 11191, 111910, 312, 3122, 31221, 312210, 31222, 312221, 312229 |
| Gambling | # | 7132, 71312, 713120, 713210, 71329, 713290, 72112, 721120 |
| Military | 3760-3769, 3795, 3480, 3483, 3484, 3489 | 336992, 336414 |
| Weapons | # | 332992-332994 |

For a complete list of all sin stocks included and retrieved from CRSP and which one who has an ESG score, see Appendix B. Sin companies are often engaged in industries beyond their main industry that is sin. To make sure we get an appropriate selection, we use an expansive criterion, by expanding upon the restrictive criteria used by Hong and Kacperczyk (2009). The way we expanded was to include SIC codes 5181, 5159 and 5194 described more in detail above. All the SIC and NAICS codes mentioned above as a whole were used to ensure a systematic process. We included every company in the industry codes that were involved with sin, not just in a production way, but also wholesales and. For the gambling industry, a company would be regarded as sin if they made casino tables, and for the alcohol industry the same goes for production of cans and bottles to the industry. The goal of the systematic process was to find the sin stocks that was viewed as sin to the "average" investor. What degree of sin that must be in place for an investor to abstain from the stocks is impossible to know, but as discussed above, that will depend heavily on what type of SRI strategy that is being implemented. One could expect the investors that use negative screening to neglect the stock because of their Value-based views. If that is the case, then an expansive criterion will suit the process. Below is list of all the sin stocks in our sample with the respective industry and year.

Table 2: Distribution of sin companies per industry

| Year | Total | Tobacco | Alcohol | Gambling | Weapons |
|---|---|---|---|---|---|
| 2002 | 6 | 1 | 2 | 1 | 2 |
| 2003 | 7 | 1 | 2 | 1 | 3 |
| 2004 | 7 | 1 | 2 | 3 | 1 |
| 2005 | 10 | 1 | 3 | 3 | 3 |
| 2006 | 11 | 1 | 3 | 3 | 4 |
| 2007 | 8 | 1 | 1 | 3 | 3 |
| 2008 | 11 | 1 | 1 | 5 | 4 |
| 2009 | 13 | 2 | 1 | 5 | 5 |
| 2010 | 10 | 2 | 1 | 4 | 3 |
| 2011 | 8 | 1 | 1 | 5 | 1 |
| 2012 | 8 | 1 | 1 | 4 | 2 |
| 2013 | 6 | 1 | 0 | 4 | 1 |
| 2014 | 5 | 1 | 0 | 3 | 1 |
| 2015 | 12 | 2 | 1 | 7 | 2 |
| 2016 | 15 | 2 | 2 | 9 | 2 |
| 2017 | 16 | 3 | 2 | 8 | 3 |
| 2018 | 14 | 2 | 2 | 7 | 3 |
| 2019 | 15 | 2 | 2 | 8 | 3 |

### 6.6 Regressions

In line with the majority of sin stock and ESG studies, we choose multifactor models to meassure the stock performance. The models are up to date with latest research on the subject.

#### *6.6.1 Carhart four-factor Model*

Carhart (1997) expands upon the classic work of Fama and French (1993). The Fama and French three-factor model contains there factors: Small minus big (SMB), high minus low (HML) and the expected market return (MKT). In addition the to the three factors Mark Carhart adds a fourth factor, namely momentum (MOM). He discovered that high performing stocks had a tendency to continue performing well, and vice versa with underperformance. In order to exploit this systematic trend, he suggested to buy recent overperforming stocks and sell the recent underperforming stocks, as a strategy to generate excess return. The formal expression of the model are as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{1,i}(R_{mt} - R_{ft}) + \beta_{2,i}SMB_t + \beta_{3,i}HML + \beta_{4,i}WML + e_{i,t}$$[2]

Where:

$\boldsymbol{R_{i,t}}$ the return on security i at time t

$\boldsymbol{R_{f,t}}$ = The risk-free rate

$\boldsymbol{\alpha_i}$ = the risk-adjusted excess return, also known as "alpha"

$\boldsymbol{\beta_{1,2,3,4}}$ = the sensitivity on the different factors

$\boldsymbol{R_{Mt} - R_{Ft}}$ ($\boldsymbol{MKT}$) = the expected market return

$\boldsymbol{SMB}$ = the difference between the return on a small-cap portfolio at time t, and the return of a large-cap portfolio at time t

$\boldsymbol{HML}$ = the difference between the return on a high book-to-market portfolio at time t and the return on a low-to-book-market portfolio at time t

$\boldsymbol{WML}$ = the return on the two high-prior-return on the two low-prior-return portfolio

### *6.6.3 Fama-French five-factor model*

Similarly to the four-factor model, Fama and French (2014) extends upon their previous work on the three factor model. Instead of using the momentum factor they found two new factors to be included. Profitability, or conservative minus weak (CMA) and investestment, or robust minus weak (RMW) was included. Fama and French discovered that firms with higher future earnings reported, tended to have higher returns in the stock market, hence CMA. They also discovered that companies invloved in major growth projects were likly to experience losses in the stock market, hence RMW.

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{1,i}(R_{mt} - R_{ft}) + \beta_{2,i}SMB_t + \beta_{3,i}HML + \beta_{4,i}RMW_t + \beta_{5,t}CMA + e_{i,t}$$

Where:

$\boldsymbol{R_{i,t}}$ the return on security i at time t

[2] Note: where «i» is defined as an individual security, "p" could be replaced to express a portfolio.

$\boldsymbol{R_{f,t}}$ = The risk-free rate

$\boldsymbol{\alpha_i}$ = the risk-adjusted excess return, also known as "alpha"

$\boldsymbol{\beta_{1,2,3,4,5}}$ = = the sensitivity on the different factors

$\boldsymbol{R_{Mt} - R_{Ft}}$ ($\boldsymbol{MKT}$) = the expected market return

$\boldsymbol{SMB}$ = the difference between the return on a small-cap portfolio at time t, and the return of a large-cap portfolio at time t

$\boldsymbol{HML}$ = the difference between the return on a high book-to-market portfolio at time t and the return on a low-to-book-market portfolio at time t

$\boldsymbol{RMW}$ = the difference between the return on a robust operating portfolio and a the return on a weak operating portfolio

$\boldsymbol{CMA}$ = the difference between the return on a conservative investment portfolio and the return on an aggressive investment portfolio

### *6.6.4 Fama and French five-factor model plus BAB*

The last model we are going to include is the Fama French five-factor model with Betting Agianst Beta (BAB) as an extension to the model made famous by Frazzini and Pedersen (2014). One efficiency of the capital asset pricing model is that higher beta assets tend to be overpriced, and lover beta assets end to be underpriced. Furthermore, investors tend to be constrained in the amount of leverage they have available. This leads them to having an overweight of high beta assets in their portfolio, and an underweight of low beta assets, which in turn makes the riskier assets be associated with a low risk-adjusted return. The BAB factor corrects this protentional anomaly by taking a long position in low beta stocks and short-sell high beta stocks.

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{1,i}(R_{mt} - R_{ft}) + \beta_{2,i}SMB_t + \beta_{3,i}HML + \beta_{4,i}RMW_t + \beta_{5,t}CMA + \beta_{6,t}BAB + e_{i,t}$$

Where:

$\boldsymbol{R_{i,t}}$ the return on security i at time t

$\boldsymbol{R_{f,t}}$ = The risk-free rate

$\boldsymbol{\alpha_i}$ = the risk-adjusted excess return, also known as "alpha"

$\boldsymbol{\beta_{1,2,3,4,5,6}}$ = the sensitivity on the different factors

$\boldsymbol{R_{Mt} - R_{Ft}}$ ($\boldsymbol{MKT}$) = the expected market return

***SMB*** = the difference between the return on a small-cap portfolio at time t, and the return of a large-cap portfolio at time t

***HML*** = the difference between the return on a high book-to-market portfolio at time t and the return on a low-to-book-market portfolio at time t

***RMW*** = the difference between the return on a robust operating portfolio and a the return on a weak operating portfolio

***CMA*** = the difference between the return on a conservative investment portfolio and the return on an aggressive investment portfolio

**BAB** = the difference between the return on a leveraged low-beta portfolio and the return of a high beta portfolio

## 6.0 Validity

The results from our regression analysis and previous research has shown that the models used are the most suitable to examine our research question. This section is meant to validate the models used and the results produced.

### 7.1 ESG-related issues

There are several aspects to consider when including ESG in the data set. As we mentioned in the introduction there are especially three issues that need to be addressed due to the imperfect (and increasing over time) coverage of companies in Refinitiv. The asymmetric distribution of companies by year in our sample 2002 - 2019 is severe. In the early 1990s fewer than 20 companies reported ESG information, but in 2014 a total of 8500 companies did report (Serafeim & Grewal, 2016). All the issues and problems presented in this section may present themselves simultaneously, and lead to biases and/or difficulties in interpreting the results of our empirical investigation.

#### *7.1.1 ESG and firm size*

Several studies find a positive relationship between firm size and CSP, (Orlitzky, 2001; Wu, 2006). Their research on ESG is at the early age of ESG scores, a time when very few companies reported ESG information. In more recent studies Pérez (2015) and King and Bartels (2015) found evidence that CSR reports has grown in the last years and Chauhan (2014) takes this further and indicates that CSR

expenditure grows with firm size. In the latest study on firm size by Drempetic et al. (2019) they provide evidence that current ESG scores do not measure the CSP realistically. They state that the main driver for ESG scores are firm size, and firm size is mainly determined by data availability and resources. Implicitly argued, this mean that having an ESG score, especially early on in our sample, will be firm size biased, and not necessarily provide much information about good or bad ESG performance. We could provide some data on firm size and other relevant variables to use it in our analysis, but that would be too comprehensive for this paper, and hence, out of our scope.

#### *7.1.2 ESG score or not?*

There is an issue on whether having an ESG score in itself, indicate better ESG performance. In order to require an ESG score the company most surpass ESG reporting, and hence care sufficiently about ESG to do so. Companies without an ESG score may indicate disregard of ESG concerns. To there are two potential ways to entangle this problem. If possible, one could attain ESG related information from companies which do not have or had ESG and compare ESG performance with a portfolio with only ESG stocks. Nevertheless, the data process would be extremely difficult. The second way to entangle this problem is to compare a portfolio with stocks that do not have ESG scores with an ESG-portfolio, Since there are no metric to measure the ESG performance for the non-ESG portfolio, one could find a suitable proxy that is heavily correlated with ESG performance that is possible to find for the non-ESG portfolio. This method would most likely bring up other issues and biases since the ESG-portfolio probably would be correlated with the proxy as well. If the non-ESG portfolio showed very poor ESG, the results might indicate that companies that do not have an ESG score itself reflect a disregard for ESG itself, and those who has cares sufficiently enough.

#### *7.1.3 ESG reporting, or ESG performance?*

The issue whether ESG reporting affects ESG performance or vice versa, can be addressed as a simultaneously-causality problem. Waddock and Graves (1997) addresses the problem in context of quality of stakeholder and quality of management. Evidence suggest that larger companies has more available

resources and use those for ESG purposes. If this is the case, it will also indicate firm size bias as mentioned in 7.1.1. One way to entangle this is to include firm size and/or revenues to look for relationships. Simultaneously causality is by itself a challenging bias to entangle.

### 7.3 Delisting bias

A challenge that occurs when using large data sets with a long time period, is that some companies delist throughout the sample period. This problem is referred to as survivorship bias Brown et al. (1992). Brown et al. Examined the relationship between volatility and return and found numerical evidence that is considered strong enough to account for evidence favoring return predictability. The data from CRSP and Thomas Reuters DataStream includes data from delisted companies, but according to Shumway (1997) there are a substantial amount of delisting data that is missing in the CRSP database, hence survivorship bias is something to keep in mind, but out our skill set to entangle.

### 7.4 Omitted variable bias

To be exposed to omitted variable bias, two effects need to be present for the omitted variable:

1. The omitted variable must be correlated with at least one of the other independent variables.
2. There must be a correlation between the dependent variable and the omitted variable.

Omitted variables makes the dependent variable inconsistent. The independent variables and control variables used are drawn upon economic arguments made by previous (Fischer & Sawczyn, 2013; Velte, 2017). The tricky part of the analysis is to find the balance between too few and too many variables. With too many variables the degrees of freedom would decrease and the variance would increase. Since abnormal sin stock returns has been showed to disappear Fabozzi et al. (2016) with the CMA, RMW and BAB factors, we will use the factors to avoid a potential omitted variable bias.

### 7.6 Measurement error

If any of the data are incorrectly collected or reported, a measurement error will be present. As with many other biases, measurement error leads to inconsistent estimators, and thereby, wrong results. In our paper the potential for measurement error is to be found attached to the data collection of ESG scores from Thomas Reuter and the remaining stock data from CRSP. By scouting for potential outliers, one can roughly assume the data are accurate and we find no alerting observations. The ESG data, on the other hand, exhibits some problems that need to be addressed. There is a standardization problem with ESG data, companies standardize the data differently Waddock & graves (1997); elzahar, Hussainey, Mazzi & Tsakavoutas, (2015). There is also a transparency problem, and fairly high differences in the methodology in the ESG data Olmedo, Torres and Izquierdo (2010). Because of these problems, we cannot make generalized conclusion between sin stock performance and ESG ratings, we can only make conclusions that is valid for Thomas Reuter and not for e.g. the Sustainalaytics database. There is today an ongoing debate on how to accurately measure ESG. One issue discussed and reviewed by Siew (2015) is how the lack of standardization in the corporate rating tools, have been exploited by companies to hide their actual practices. They might disclose their information to their advantage. For sin companies the issue might be even larger due to their already "bad" reputation.

### 7.7 Multicollinearity

When there is a perfect correlation between two or more variables we have perfect multicollinearity. There are software packages that will give a warning if perfect multicollinearity occur, however. Perfect multicollinearity seldom occur. Imperfect multicollinearity, on the other hand, occurs more often, and it need to be addressed. It can be detected if the individual coefficients show high R-square and high standard errors, and the regression becomes very sensitive and the confidence intervals will be wide Brooks (2014). Near multicollinearity can be detected by constructing and looking at a correlation matrix. From the correlation matrix in Appendix, we find no evidence of multicollinearity. The correlation

matrix will not give any guarantee that there is no problem with multicollinearity, but it serves well as a solid indicator.

# 7.0 Statistics

## 7.1 Descriptive statistics

**Table 2: *Descriptive statistic***

| Measures | *Portfolio 1* | *Portfolio 2* | *Portfolio 3* | *Portfolio 4* | *Portfolio 5* | *Portfolio 6* |
|---|---|---|---|---|---|---|
| Mean | 1,2600 | 1,3081 | 1,3339 | 4,8084 | 0,6678 | 0,6887 |
| Standard Error | 0,3688 | 0,4109 | 0,3701 | 0,5380 | 0,3119 | 0,3128 |
| Median | 1,8685 | 1,8428 | 1,6447 | 3,9340 | 0,8576 | 0,8847 |
| Mode | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A |
| Standard Deviation | 5,4200 | 6,0384 | 5,4388 | 7,9066 | 4,5844 | 4,5966 |
| Sample Variance | 29,3768 | 36,4624 | 29,5806 | 62,5139 | 21,0168 | 21,1287 |
| Kurtosis | 4,7958 | 7,1306 | 1,8361 | 26,9004 | 2,3464 | 2,5340 |
| Skewness | 0,2688 | 0,4041 | -0,0952 | 3,2084 | -0,3539 | -0,3245 |
| Range | 49,7758 | 59,4094 | 40,2676 | 86,9750 | 37,9042 | 38,7850 |
| Minimum | -18,4927 | -20,9912 | -16,9717 | -12,6580 | -18,9532 | -18,9188 |
| Maximum | 31,2831 | 38,4182 | 23,2959 | 74,3171 | 18,9510 | 19,8662 |
| Sum | 272,1514 | 282,5529 | 288,1136 | 1038,6041 | 144,2357 | 148,7596 |
| Count | 216,0000 | 216,0000 | 216,0000 | 216,0000 | 216,0000 | 216,0000 |
| Largest(1) | 31,2831 | 38,4182 | 23,2959 | 74,3171 | 18,9510 | 19,8662 |
| Smallest(1) | -18,4927 | -20,9912 | -16,9717 | -12,6580 | -18,9532 | -18,9188 |
| Confidence Level(95,0%) | 0,7269 | 0,8098 | 0,7294 | 1,0604 | 0,6148 | 0,6165 |

*Portfolio 1: All SIN Stocks*
*Portfolio 2: SIN w/ ESG*
*Portfolio 3: SIN GOOD ESG*
*Portfolio 4: SIN BAD ESG*
*Portfolio 5: Saint Portfolio*
*Portfolio 6: Market Portfolio*

Table x presents all the statistical summary of the portfolios we investigate with subsequent explanations for the portfolios underneath. The mean results are in percentage form, and the portfolio with the best mean return was portfolio 4, with a 4,81 percent mean return per month. The portfolio with the worst mean return was portfolio 5 with a 0,6678 percent mean return. In other words, the worst ESG stocks had the best mean return and the best ESG stocks had the worst, noticeably under the market mean return of 0,6687. Portfolio 1 – portfolio 3 which all are sin portfolios, all show solid mean returns around twice as much as the market. Standard errors are also solid with respect to the returns. Portfolio 4, also has the highest standard error, which is also reasonable to assume. The same goes for the saint portfolio, which has the lowest standard error. The distribution among the portfolios between mean return and standard error seems linear. That means, that companies that take more risk get higher expected returns. Portfolio 4 also has the

highest standard deviation, skewness and kurtosis with their respective values of 7,9, 3,2 and 26,9. These are all high number compared to the other portfolios. There might be some validity problem or bias that causes these large numbers for portfolio 4. One thing to notice, is that all portfolios contain high standard variations, it is hard to understand the reason why only from descriptive statistics, but there might be some validity problems that causes the high numbers.

### 7.2 Correlation matrix

Table 3: Correlation matrix

| | *Mkt-RF* | *SMB* | *HML* | *RMW* | *CMA* | *BAB* |
|---|---|---|---|---|---|---|
| Mkt-RF | **1,0000** | 0,3479 | 0,1799 | -0,5014 | -0,0262 | 0,0514 |
| SMB | 0,3479 | **1,0000** | 0,2815 | -0,3376 | 0,1680 | 0,0924 |
| HML | 0,1799 | 0,2815 | **1,0000** | -0,0295 | 0,4568 | 0,1197 |
| RMW | -0,5014 | -0,3376 | -0,0295 | **1,0000** | -0,0809 | 0,0624 |
| CMA | -0,0262 | 0,1680 | 0,4568 | -0,0809 | **1,0000** | 0,1306 |
| BAB | 0,0514 | 0,0924 | 0,1197 | 0,0624 | 0,1306 | **1,0000** |

Table x shows the result of the pair-wise correlation matrix. The first thing to notice is the lack of extreme observation. The pillars with the highest correlation are between RMW and SMB with -0,5014, and between HML and CMA with 0,4568. The results indicate an even distribution of correlation among the factors. BAB shows the lowest correlation with the other factors. By observing the result, one could assume that multicollinearity will not cause any sever challenges, since non of the above exceeds the absolute value of 0,9, which is where the multicollinearity problem arises. The factors used in our models are well established factors in the field of finance, and thence, it is reasonable to assume that researchers have tested the factors for multicollinearity prior to our paper.

## 8.0 Results and analysis

The three regressions that were explained in chapter 6.6 has been run on all six of our portfolios. In this chapter, we will present the results and see if our hypotheses hold.

The results are summarized in the panels below.

**8.1 Table 4: Portfolio 1 – All Sin stocks**

| | | | |
|---|---|---|---|
| Alpha | 0,62843*** | 0,3740** | 0,4175** |
| | **0,1926** | **0,1985** | **0,2016** |
| Mkt-Rf | 0,8595*** | 1,0109*** | 1,0161*** |
| | **0,0531** | **0,0552** | **0,0553** |
| SMB | 0,52323*** | 0,5846*** | 0,5922*** |
| | **0,0850** | **0,0860** | **0,0862** |
| HML | 0,2791*** | 0,2529*** | 0,2557*** |
| | **0,0802** | **0,0889** | **0,0889** |
| WML | (0,1577)*** | | |
| | **0,0472** | | |
| RMW | | 0,4251*** | 0,4423*** |
| | | **0,1140** | **0,1148** |
| CMA | | -0,0445 | -0,0272 |
| | | **0,1378** | **0,1384** |
| BAB | | | -0,0719 |
| | | | **0,0597** |
| R-squared | 74,18 % | 74,81 % | 74,98 % |

*** Indicates significance on a 1% confidence level
** Indicates significance on a 5% confidence level
* Indicates significance on a 10% confidence level
Note: Bold values display the standard error

The table above summarizes the regression conducted on our sin stock portfolio. We notice that for the Carhart four-factor regression, all independent variables are statistically significant on the 1%, 5% and 10% confidence levels. Alpha is 0,67% per month, which is strongly economically significant. When performing our second regression, which is a Fama and French 5-Factor regression, we see the Alpha value reduced to 0,37%. This indicates that the Fama and French five-factor regression has an increased explanatory power compared with the Carhart four-factor regression. This is further confirmed by a slight increase in the R-squared. All the research factors are strongly significant, both statistically and economically, except the investment factor (CMA). The CMA factor looks at the difference between the return on a conservative investment portfolio and the return on an aggressive investment portfolio. This could mean that a sizeable quantity of the sin companies in portfolio 1, does not invest aggressively into expanding their business,
but rather chose to stay in their respective marketshares and slowly develop their market share, which would make sense.

**Commented [MØO2]:** Kanskje endre eller kutte før innlevering.

Interestingly, when adding the BAB factor, we see a negligible increase in the models explanatory power, however the BAB-factor is rendered both statistically and economically insignificant. Additionally, the CMA-factor remains insignificant, and alpha and standard errors increase.

### 8.2 Table 5: Portfolio 2 – Sin stocks with ESG Scores

| | | | |
|---|---|---|---|
| Alpha | 0,5789*** | 0,2459 | 0,2811 |
| | **0,2227** | **0,2176** | **0,2213** |
| Mkt-Rf | 1,0481*** | 1,2320*** | 1,2363*** |
| | **0,0613** | **0,0605*** ** | **0,0607** |
| SMB | 0,3323*** | 0,4687*** | 0,4749*** |
| | **0,0982** | **0,0943** | **0,0946** |
| HML | 0,2680*** | 0,2829*** | 0,2852*** |
| | **0,0927** | **0,0975** | **0,0975** |
| WML | (0,1368)** | | |
| | **0,0545** | | |
| RMW | | 0,6726*** | 0,6865*** |
| | | **0,1249** | **0,1260** |
| CMA | | -0,2190 | -0,2050 |
| | | **0,1510** | **0,1519** |
| BAB | | | -0,0582 |
| | | | **0,0656** |
| R-squared | 72,20 % | 75,62 % | 75,71 % |

Portfolio 1 consists of 95 sin companies. 55 of these have been assigned ESG Scores and have been placed in portfolio 2. It is therefore not unexpected that the regression output for the two portfolios have a lot in common. When conducting the Carhart four-factor regression, we end up with approximately the same result as for portfolio 1, but with a slightly lower R-squared. When proceeding with the 5-Factor model, and when adding the BAB-factor, we see that the CMA- and BAB-factors are yet again statistically insignificant, as with our previous portfolio. We also note that Alpha is statistically insignificant and barely economic significant. It is worth to note that the standard errors have increased across the board. Lastly, explanatory values for the independent variables has increased, which leads to a higher R-squared than for portfolio 1.

**8.3 Table 6: Portfolio 3 – Sin stocks with good ESG Score**

| | | | |
|---|---|---|---|
| Alpha | 0,6689*** | 0,4392* | 0,4922** |
| | **0,2366** | **0,2393** | **0,2430** |
| Mkt-Rf | 0,9376*** | 1,0318*** | 1,038*** |
| | **0,0652** | **0,0666** | **0,0667** |
| SMB | 0,2493** | 0,3403*** | 0,3495*** |
| | **0,1044** | **0,1037** | **0,1039** |
| HML | 0,3083*** | 0,1919* | 0,1953* |
| | **0,0985** | **0,1072** | **0,1071** |
| WML | 0,0344 | | |
| | **0,0579** | | |
| RMW | | 0,5090*** | 0,5299*** |
| | | **0,1072** | **0,1383** |
| CMA | | 0,0667 | 0,0877 |
| | | **0,1661** | **0,1668** |
| BAB | | | -0,0875 |
| | | | **0,0720** |
| R-squared | 61,32 % | 63,65 % | 63,90 % |

When performing a Carhart four-factor regression, we obtain an Alpha of 0,67%, which is both highly statistically and economically significant. The R-squared is also lower compared to portfolio 1 and 2. We will see an even more extreme occurrence of this for portfolio 4 below, which contains our sin stocks with poor ESG Scores. The Alphas do support the general idea, that SIN stock returns are largely affected by social norms. We see that the Mkt-Rf- and HML-factors are strongly statistically significant. Naturally, Mkt-Rf has a strong economic significance as well. SMB is statistically significant for a 5% confidence interval and somewhat economically significant. The momentum factor (WML) is not statistically significant for any confidence interval, nor does it have any economic explanatory power.

After including the RMW- and CMA-factors, R-squared increases to 63,65% and alpha decreases to 0,43%. Alpha is still economically significant, but just statistically significant at a 10% confidence interval. The table also displays that the CMA factor is yet again statistically and economically insignificant. By adding the BAB-factor to our regression model, we see that it is statistically and economically insignificant, and does not affect our regression model in any meaningful way.

**8.4 Table 7: Portfolio 4 – Sin stocks with a bad ESG Score**

| | | | |
|---|---|---|---|
| Alpha | 4,7493*** | 4,5212*** | 4,4496*** |
| | **0,5510** | **0,5713** | **0,5815** |
| Mkt-Rf | 0,0275 | 0,1079 | 0,0992 |
| | **0,1518** | **0,1589** | **0,1596** |
| SMB | 0,1986 | 0,3210 | 0,3085 |
| | **0,2430** | **0,2476** | **0,2486** |
| HML | 0,1501 | 0,0211 | 0,0165 |
| | **0,2293** | **0,2559** | **0,2563** |
| WML | 0,0764 | | |
| | **0,1349** | | |
| RMW | | 0,5496* | 0,5213 |
| | | **0,2559** | **0,3310** |
| CMA | | 0,0405 | 0,0121 |
| | | **0,3964** | **0,3991** |
| BAB | | | 0,1183 |
| | | | **0,1723** |
| R-squared | 0,74 % | 1,97 % | 2,19 % |

Not a single independent variable has any statistical or economic significance, independent of which regression you run, RMW is the exception. RMW has economic significance and a statistical significance at a 10% confidence interval, until the BAB-factor is added. Alpha is in the range 4,45-4,75 and is the only variable with any significance. R-squared is in the range of 0,74% - 2,19%. Hence, explaining the historical and expected stock movement is not possible using the factor-models. What causes such a large Alpha is out of the scope of this paper but could probably stem from unsystematic risk and a substantial amount of social norms and controversy regarding the poor ESG Scores. They are known to affect institutional investors, as well as several individual investors.

**8.5 Table 8: Portfolio 5 – Saint stocks**

| | | | |
|---|---|---|---|
| Alpha | 0,0399 | 0,0554 | 0,0524 |
| | **0,0773** | **0,0872** | **0,0889** |
| Mkt-Rf | 0,8386*** | 0,8588*** | 0,8584*** |
| | **0,0213** | **0,0243** | **0,0244** |
| SMB | 0,5651*** | 0,5181*** | 0,5176*** |
| | **0,0341** | **0,0378** | **0,0380** |
| HML | 0,0993*** | 0,0994** | 0,0992** |
| | **0,0322** | **0,0391** | **0,0392** |
| WML | (0,1393)*** | | |
| | **0,0189** | | |
| RMW | | (0,1660)*** | (0,1672)*** |
| | | **0,0391** | **0,0506** |
| CMA | | -0,0014 | -0,0026 |
| | | **0,0605** | **0,0610** |
| BAB | | | 0,0050 |
| | | | **0,0263** |
| R-squared | 94,18 % | 93,20 % | 93,21 % |

From the table in portfolio 5, we got low and statistically insignificant alphas. The Market factor has a high explanatory power and the factor is statistically significant for all three models. RMW and HML are the two factors that sticks out in terms of statistical significance. Additionally, R-squared is very high for all three models. CMA is not statistical nor economic significant, which has been a common occurrence in our portfolios.

**8.6 Table 9: Portfolio 6 – Market portfolio**

| | | | |
|---|---|---|---|
| Alpha | 0,0619 | 0,0650 | 0,0634 |
| | **0,0785** | **0,0893** | **0,0910** |
| Mkt-Rf | 0,8385*** | 0,8653*** | 0,8651*** |
| | **0,0216** | **0,0248** | **0,0250** |
| SMB | 0,5622*** | 0,5195*** | 0,5192*** |
| | **0,0346** | **0,0387** | **0,0389** |
| HML | 0,1062*** | 0,1065*** | 0,1064*** |
| | **0,0327** | **0,0400** | **0,0401** |
| WML | (0,1427)*** | | |
| | **0,0192** | | |
| RMW | | (0,1412)*** | (0,1419)*** |
| | | **0,0400** | **0,0518** |
| CMA | | -0,0028 | -0,0035 |
| | | **0,0620** | **0,0625** |
| BAB | | | 0,0027 |
| | | | **0,0270** |
| R-squared | 94,04 % | 92,91 % | 92,91 % |

Several connections can be drawn between portfolio 5 and portfolio 6. Almost in line with portfolio 5, portfolio 6 consist of stocks of the whole market and exhibit some of the same characteristics. The alpha in all the models are both small and statistically insignificant, which what to expect from a broad portfolio. R-square is very high for all models and highest for the four-factor model with 94,04 percent. The market factor is both economically and statistically highly significant. The market explains around 0,85 percent of the return for all three models. A substantial amount of the coefficients is economically significant and, in most cases,, statistically significant. One logical explanation for high R-square and large coefficients is the fact that the factors used in our models have been proven to explain some of the market, and when using a broad market portfolio, the results should show high r-square and large coefficients.

**8.7 Results**

In this section, we will summarize our results and use them to decide whether to retain or dismiss the various null-hypotheses that were defined in section 5.

| | | Carhart | FF5 | FF5 + BAB |
|---|---|---|---|---|
| | Alpha | 4,7493*** | 4,5212*** | 4,4496*** |
| Portfolio 4: Sin with bad ESG | | **0,5510** | **0,5713** | **0,5815** |
| | Alpha | 0,6689*** | 0,4392* | 0,4922** |
| Portfolio 3: Sin with good ESG | | **0,2366** | **0,2393** | **0,2430** |
| | Alpha | 0,62843*** | 0,3740** | 0,4175** |
| Portfolio 1: Sin stocks | | **0,1926** | **0,1985** | **0,2016** |
| | Alpha | 0,5789*** | 0,2459 | 0,2811 |
| Portfolio 2: Sin with ESG | | **0,2227** | **0,2176** | **0,2213** |
| | Alpha | 0,0619 | 0,0650 | 0,0634 |
| Portfolio 6: Market Portfolio | | **0,0785** | **0,0893** | **0,0910** |
| | Alpha | 0,0399 | 0,0554 | 0,0524 |
| Portfolio 5: Saint Portfolio | | **0,0773** | **0,0872** | **0,0889** |

Table X: Summary of dependent variables

Table X summarizes the alpha values for all six of our portfolios, sorted from highest to lowest. Our results show that sin stocks provide abnormal returns compared to investing in other industries, which corresponds with the conclusion of Hong and Kacperczyk (2009). By expanding upon their framework and considering ESG Scores, we have also found that sin stocks with a poor ESG Score significantly outperforms sin stocks with a good ESG score. The Saint Portfolio provides the lowest expected return.

The evidence leads us to reject and retain the and the following hypotheses:

| Hypothesis | $H_0$ | $H_A$ | Result |
|---|---|---|---|
| **H1** | Reject | Retain | Sin stock portfolio outperforms "market portfolio" and "saint portfolio" |
| **H2** | Reject | Retain | Sin stock portfolio with ESG scores outperform "market portfolio" and "saint portfolio" |
| **H3** | Retain | Reject | Sin stocks with a bad ESG score outperforms Sin stocks with a good ESG Score + the "market portfolio" and "saint portfolio |
| **H4** | Retain | Reject | Saint portfolio underperforms compared to all other portfolios |
| **H5** | Retain | Reject | Market portfolio underperforms compard to all sin portfolios |

## 9.0 Conclusion and Discussion

This paper provides solid evidence that sin stocks generate abnormal returns. The evidence stems from publicly traded companies in the US involved in the production of alcohol, tobacco, gambling and weapons. Neither of the well-known predictors were able to explain the anormal return of the sin portfolios that contained ESG scores in any significant way. Hence, the return must originate from variables that are difficult or impossible to measure. The main peculiarity concerning sin stocks is their controversy, which becomes increasingly prominent in today's society where SRI investing and CSR are trending. The result is that an increasing number of investors who avoid sin industries and less analysts who cover the industries.

With background in recent research papers, we expected sin stocks to yield an abnormal return compared to the market portfolio. Few research papers have on the other hand investigated how ESG scores affect these abnormal returns. Hence, we made it our objective to solve this challenge and foundthat sin stocks with a poor or no ESG Score significantly outperformed sin stocks with a good ESG Score.

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## 12.0 Appendices

## Appendix A

Table 1: Research SIN companies

| Research | SIN Industries | Sample period |
|---|---|---|
| Waxler (2004) | Alcohol, tobacco, gambling and weapon | # |
| Chong, Her and Phillips (2006) | Vice Fund | 2002-2005 |
| Salaber (2007) | Alcohol, tobacco and gambling | 1975-2006 |
| Fabozzi, Ma, and Oliphant (2008) | Alcohol, tobacco, gambling, adult entertainment, biotech and weapon | 1970-2007 |
| Hong and Kacperczyk (2009) | Alcohol, tobacco and gambling | 1965-2006 |
| Statman and Glushkov (2009) | Alcohol, tobacco and gambling | 1992-2007 |
| Liston and Soydemir (2010) | Alcohol, tobacco and gambling | 2001-2007 |
| Areal, Cortez and Silva (2010) | Alcohol, tobacco, gambling and weapon | 1993-2009 |
| Kim and Venkatachalam (2011) | Alcohol, tobacco, gambling and adult entertainment | 1988-2006 |
| Jo and Na (2012) | Alcohol, tobacco and gambling | 1991-2010 |
| Cai, Jo and Pan (2012) | Alcohol, tobacco, gambling, weapon, oil, cement and biotech | 1995-2009 |
| Durand, Koh and Tan (2013) | Alcohol, tobacco and gambling | 1990-2009 |
| Durand, Koh and Limkriangkrai (2013) | Alcohol, tobacco and gambling | 1990-2008 |
| Fauver and McDonald IV (2014) | Alcohol, tobacco and gambling | 1995-2009 |
| Hoepner and Zeume (2014) | Vice Fund | 2002-2008 |
| Adamsson and Hoepner (2015) | Alcohol, tobacco and gambling | 2002-2013 |
| Richey (2016) | Alcohol, tobacco, gambling and weapon | 1995-2015 |
| Lobe and Walkshäusl (2016) | Alcohol, tobacco, gambling, adult entertainment and nuclear power | 1995-2007 |
| Liston (2016) | Alcohol, tobacco and gambling | 1988-2009 |
| Sabherwal, Sarkar and Uddin (2017) | Alcohol, tobacco and gambling | 1926-2014 |
| Guillamón-Saorín, Guiral and Blanco (2017) | Alcohol, tobacco, weapon and nuclear power | 2004-2008 |
| Blitz and Fabozzi (2017) | Alcohol, tobacco, gambling and weapon | 1963-2016 |

## Appendix B

| Company Name | ESG | Company Name | ESG |
|---|---|---|---|
| 22ND CENTURY GROUP INC | No | INTERNATIONAL GAME TECH PLC | Yes |
| 3M CO | No | INTRAWEST RESORTS HOLDINGS INC | No |
| 500 COM LTD | No | JEFFERIES FINANCIAL GROUP INC | Yes |
| ACTUANT CORP | No | K 2 INC | No |
| ALLIED DEFENSE GROUP INC | No | K B R INC | Yes |
| ALTRIA GROUP INC | Yes | LAS VEGAS SANDS CORP | Yes |
| ANHEUSER BUSCH COS INC | Yes | LOCKHEED MARTIN CORP | Yes |
| ANHEUSER BUSCH INBEV SA NV | Yes | LOEWS CORP | Yes |
| AXION POWER INTERNATIONAL INC | No | M G M MIRAGE | Yes |
| BEAM INC | No | M G P INGREDIENTS INC | Yes |
| BOSTON BEER INC | Yes | MARRIOTT VACATIONS WORLDWIDE COR | Yes |
| BOYD GAMING CORP | Yes | MELCO RESORT & ENTERTAINMENT LTD | Yes |
| BRITISH AMERICAN TOBACCO PLC | Yes | MERITAGE HOSPITALITY GROUP INC | No |
| C N H INDUSTRIAL N V | Yes | MILACRON INC | No |
| CAESARS ENTERTAINMENT CORP | Yes | MOLSON COORS BREWING CO | Yes |
| CAMPUS CREST COMMUNITIES INC | No | MONARCH CASINO & RESORT INC | Yes |
| CANOPY GROWTH CORP | No | NORTHROP GRUMMAN CORP | Yes |
| CANTERBURY PARK HOLDING CORP | No | NVENT ELECTRIC PLC | Yes |
| CENTURY CASINOS INC | Yes | OLIN CORP | Yes |
| CHALONE WINE GROUP LTD | No | OSHKOSH CORP | Yes |
| CHURCHILL DOWNS INC | Yes | PARK HOTELS & RESORTS INC | Yes |
| CIVEO CORP NEW | No | PENN NATIONAL GAMING INC | Yes |
| COAST DISTRIBUTION SYSTEM INC | No | PENTAIR PLC | No |

| | | | |
|---|---|---|---|
| CONSTELLATION BRANDS INC | Yes | PINNACLE ENTERTAINMENT INC NEW | Yes |
| CRAFT BREW ALLIANCE INC | Yes | PYXUS INTL INC | No |
| CROWN HOLDINGS INC | No | RAYTHEON CO | Yes |
| DEERE & CO | Yes | ROUNDYS INC | No |
| DIAGEO PLC | Yes | S P X FLOW INC | No |
| DIAMOND RESORTS INTL INC | Yes | SCHWEITZER MAUDUIT INTL INC | Yes |
| DREAMS INC | No | SCIENTIFIC GAMES CORP | Yes |
| ELDORADO RESORTS INC | Yes | SONESTA INTERNATIONAL HOTELS CP | No |
| EMRISE CORP | No | STANDARD COMMERCIAL CORP | No |
| EXTENDED STAY AMERICA INC | Yes | STURM RUGER & CO INC | Yes |
| FULL HOUSE RESORTS INC | No | SUMMIT HOTEL PROPERTIES INC | No |
| GARDEN COM INC | No | TARONIS TECHNOLOGIES INC | No |
| GENERAL DYNAMICS CORP | Yes | TRAVELERS PPTY CASUALTY CORP NEW | No |
| GENERAL ELECTRIC CO | No | TURNING POINT BRANDS INC | Yes |
| GOLDEN ENTERTAINMENT INC | Yes | TWIN RIVER WORLDWIDE HLDGS INC | No |
| GOODRICH CORP | Yes | U S T INC | Yes |
| GREENTREE HOSPITALITY GROUP LTD | No | UNITED TECHNOLOGIES CORP | No |
| HILTON GRAND VACATIONS INC | Yes | UNIVERSAL CORPORATION | Yes |
| HILTON HOTELS CORP | No | VECTOR GROUP LTD | Yes |
| HILTON WORLDWIDE HOLDINGS INC | Yes | VISTA OUTDOOR INC | Yes |
| HONEYWELL INTERNATIONAL INC | Yes | WENDYS ARBYS GROUP INC | No |
| I L X RESORTS INC | No | WILLAMETTE VALLEY VINYDS INC | No |
| I T T INDUSTRIES INC IND | Yes | WYNDHAM HOTELS & RESORTS INC | No |
| IAO KUN GROUP HOLDING CO LTD | No | WYNN RESORTS LTD | Yes |

## Appendix C

Descriptive Statistics

| Measures | *Portfolio 1* | *Portfolio 2* | *Portfolio 3* | *Portfolio 4* | *Portfolio 5* | *Portfolio 6* |
|---|---|---|---|---|---|---|
| Mean | 1,2600 | 1,3081 | 1,3339 | 4,8084 | 0,6678 | 0,6887 |
| Standard Error | 0,3688 | 0,4109 | 0,3701 | 0,5380 | 0,3119 | 0,3128 |
| Median | 1,8685 | 1,8428 | 1,6447 | 3,9340 | 0,8576 | 0,8847 |
| Mode | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A |
| Standard Deviation | 5,4200 | 6,0384 | 5,4388 | 7,9066 | 4,5844 | 4,5966 |
| Sample Variance | 29,3768 | 36,4624 | 29,5806 | 62,5139 | 21,0168 | 21,1287 |
| Kurtosis | 4,7958 | 7,1306 | 1,8361 | 26,9004 | 2,3464 | 2,5340 |
| Skewness | 0,2688 | 0,4041 | -0,0952 | 3,2084 | -0,3539 | -0,3245 |
| Range | 49,7758 | 59,4094 | 40,2676 | 86,9750 | 37,9042 | 38,7850 |
| Minimum | -18,4927 | -20,9912 | -16,9717 | -12,6580 | -18,9532 | -18,9188 |
| Maximum | 31,2831 | 38,4182 | 23,2959 | 74,3171 | 18,9510 | 19,8662 |
| Sum | 272,1514 | 282,5529 | 288,1136 | 1038,6041 | 144,2357 | 148,7596 |
| Count | 216,0000 | 216,0000 | 216,0000 | 216,0000 | 216,0000 | 216,0000 |
| Largest(1) | 31,2831 | 38,4182 | 23,2959 | 74,3171 | 18,9510 | 19,8662 |
| Smallest(1) | -18,4927 | -20,9912 | -16,9717 | -12,6580 | -18,9532 | -18,9188 |
| Confidence Level(95,0%) | 0,7269 | 0,8098 | 0,7294 | 1,0604 | 0,6148 | 0,6165 |

*Portfolio 1: All SIN Stocks*
*Portfolio 2: SIN w/ ESG*
*Portfolio 3: SIN GOOD ESG*

*Portfolio 4: SIN BAD ESG*
*Portfolio 5: Saint Portfolio*
*Portfolio 6: Market Portfolio*

**Appendix D**

Distribution by year (Portfolio 2 - All SIN Stocks with ESG Score)

| Year | Total | Tobacco | Alcohol | Gambling | Weapons |
|---|---|---|---|---|---|
| 2002 | 8 | 2 | 2 | 1 | 3 |
| 2003 | 9 | 3 | 2 | 1 | 3 |
| 2004 | 13 | 3 | 2 | 3 | 5 |
| 2005 | 14 | 2 | 3 | 3 | 6 |
| 2006 | 16 | 2 | 5 | 3 | 6 |
| 2007 | 15 | 3 | 3 | 3 | 6 |
| 2008 | 20 | 4 | 3 | 5 | 8 |
| 2009 | 20 | 4 | 3 | 5 | 8 |
| 2010 | 20 | 4 | 3 | 5 | 8 |
| 2011 | 18 | 3 | 3 | 5 | 7 |
| 2012 | 18 | 3 | 3 | 6 | 6 |
| 2013 | 17 | 3 | 3 | 5 | 6 |
| 2014 | 19 | 3 | 2 | 5 | 9 |
| 2015 | 28 | 5 | 4 | 9 | 10 |
| 2016 | 34 | 5 | 5 | 14 | 10 |
| 2017 | 36 | 6 | 6 | 13 | 11 |
| 2018 | 33 | 6 | 6 | 12 | 9 |
| 2019 | 25 | 5 | 4 | 12 | 4 |

Distribution by year (Portfolio 3 - Good ESG Score) (=>36,39)

| Year | Total | Tobacco | Alcohol | Gambling | Weapons |
|---|---|---|---|---|---|
| 2002 | 2 | 1 | 0 | 0 | 1 |
| 2003 | 2 | 2 | 0 | 0 | 0 |
| 2004 | 6 | 2 | 0 | 0 | 4 |
| 2005 | 4 | 1 | 0 | 0 | 3 |
| 2006 | 5 | 1 | 2 | 0 | 2 |
| 2007 | 7 | 2 | 2 | 0 | 3 |
| 2008 | 9 | 3 | 2 | 0 | 4 |
| 2009 | 7 | 2 | 2 | 0 | 3 |
| 2010 | 10 | 2 | 2 | 1 | 5 |
| 2011 | 10 | 2 | 2 | 0 | 6 |
| 2012 | 10 | 2 | 2 | 2 | 4 |
| 2013 | 11 | 2 | 3 | 1 | 5 |
| 2014 | 14 | 2 | 2 | 2 | 8 |
| 2015 | 16 | 3 | 3 | 2 | 8 |
| 2016 | 19 | 3 | 3 | 5 | 8 |
| 2017 | 20 | 3 | 4 | 5 | 8 |
| 2018 | 19 | 4 | 4 | 5 | 6 |
| 2019 | 10 | 3 | 2 | 4 | 1 |

Distribution by year (Portfolio 4 - Bad ESG Score) (<36,39)

| Year | Total | Tobacco | Alcohol | Gambling | Weapons |
|---|---|---|---|---|---|
| 2002 | 6 | 1 | 2 | 1 | 2 |
| 2003 | 7 | 1 | 2 | 1 | 3 |
| 2004 | 7 | 1 | 2 | 3 | 1 |
| 2005 | 10 | 1 | 3 | 3 | 3 |
| 2006 | 11 | 1 | 3 | 3 | 4 |
| 2007 | 8 | 1 | 1 | 3 | 3 |
| 2008 | 11 | 1 | 1 | 5 | 4 |
| 2009 | 13 | 2 | 1 | 5 | 5 |
| 2010 | 10 | 2 | 1 | 4 | 3 |
| 2011 | 8 | 1 | 1 | 5 | 1 |
| 2012 | 8 | 1 | 1 | 4 | 2 |
| 2013 | 6 | 1 | 0 | 4 | 1 |
| 2014 | 5 | 1 | 0 | 3 | 1 |
| 2015 | 12 | 2 | 1 | 7 | 2 |
| 2016 | 15 | 2 | 2 | 9 | 2 |
| 2017 | 16 | 3 | 2 | 8 | 3 |
| 2018 | 14 | 2 | 2 | 7 | 3 |
| 2019 | 15 | 2 | 2 | 8 | 3 |