BI Norwegian Business School - campus Oslo

GRA 19703

Master Thesis

Thesis Master of Science

Does ESG Investments Come at a Cost?

Navn:	Eirin Eiken Cruz, Steffan Jansen

Start:	15.01.2020 09.00
Finish:	01.09.2020 12.00

Abstract

This thesis investigates the financial market's reaction to the implementation of ESG related investment methods. In order to investigate this, we estimated the risk-adjusted performance, evaluated and compared a high-rated ESG (i.e. Virtue) portfolio with a low-rated ESG portfolio (i.e. Sin) and a portfolio based on sin industries defined by Hong and Kacperczyk (2009) (i.e. SinHK). We find that there is mixed evidence on whether sustainable investing implies financial cost. Moreover, by implementing an investment strategy based on ESG rating might results in a tilt on size, where we also discovered a positive correlation between ESG and Size. Furthermore, we find evidence supporting Hong and Kacperczyk (2009) hypothesis, however, we do not find that there is any statistical significant outperformance of any of the portfolios in regards to abnormal returns.

Acknowledgement

We want to thank our supervisor, Professor Bruno Gerard, for his availability, valuable advice, and guidance throughout the process of writing this thesis.

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1 Introduction

The importance of environmental and social responsibility has experienced a strong growth worldwide the past decades. This has subsequently led to an increased focus on socially responsible investments (SRI), where investor must balance the dual objective of maximizing profit and social responsibility (Schueth, 2003).
Beal et al. (2005) argues that the growing concerns over sustainable development have resulted in the rise of SRI. Furthermore, it is hypothesized that SRI provides a vehicle for social change, this however is not proven statistically. Big players in the Norwegian investment community such as Norges Bank Investment Management (NBIM) have implemented SRI and shifted their focus towards environmental, social and governmental (ESG) investment (Norges Bank Investment Management, 2020) There is a continued growth in the number of organizations are signing the UN-supported Principle for Responsible Investment agreement (UNPRI, 2019). When signing the PRI, the investor publicly commits to adopt and implement the principles, however, these principles are voluntary and aspirational.

In an attempt to measure firms' CSR level, ESG scores have become a central tool. This score helps guide the investor when deciding where to invest. Additionally, the investor can use positive or negative screening when creating a portfolio, where the choice of method may have an impact on the end result. Despite the increased research on this field, the research yields conflicting results in terms of whether ESG investments outperform, underperform or is neutral relative to conventional counterparts (Margolis and Walsh, 2003; Orlitzky, 2003). There has also been conducted studies on the opposite of ESG investing, which is investing in sin stocks. However, studies on sin stock performance also yields conflicting results (Hong and Kacperczyk, 2009; Blitz and Fabozzi, 2017). Due to the increased focus on ESG, it is important to gain knowledge of the financial impact this focus will have on client`s portfolios. To be able to shed light on whether ESG investments are profitable financially or not, is thus a major motivation for our paper. Many proponents of ESG-focused investments often argue that it is not just beneficial for the society, but also profitable for investors. This makes us want to ask the question: Does investing in high rated ESG stocks come at a cost?

Correspondingly, we want to investigate whether the opposite might be true. That investing in low ranked ESG stocks, so-called "sin" stocks, will be profitable for an investor instead. In addition to this we also want to examine if a portfolio composed of only sinful industries can be more profitable. Investigating both of these areas is interesting compared to other papers, who mostly have focused on either "virtue" or "sin" stocks impact on investments returns. Thus, this master thesis aims to study the effect of ESG investing on the financial performance and firm characteristics.

2 Literature Review

Over the past decade the expectations of companies to take more responsibility for their effect on the environment and society has increased, known as a corporate's social responsibility (CSR). The literature also refers to another important term connected to SRI and CSR, this is the Environmental, Social, and Governance (ESG) criteria. ESG is a set of standards which combines the environmental and social impact of a firm with its Corporate Governance performance, i.e. ESG is CSR plus Governance (Gerard, 2019).

Furthermore, the increased concern for social responsibility has led to the formulation and adoption of the United Nations six Principles for Responsible Investments (PRI) by investors. The PRI defines responsible investment as a strategy and practice to incorporate ESG factors in investing decisions and active ownership. It argues that to ignore ESG factors is to ignore risks and opportunities that have a material effect on the returns delivered to clients and beneficiaries (UNPRI, 2019). However, Kotsantonis et al. (2016) argue that research has shown that there is a wide range of ESG metrics used and most of those surveyed do not appear to have the necessary governance and incentive systems to ensure meaningful integration of ESG factors in investment strategy. Moreover, the lack of industry standards to guide ESG reporting and the increasingly "noisy" ESG reporting environments further complicates the adoption of ESG investing.

The most common ESG investing strategies can be broadly classified into two groups: Negative and positive screens. Negative screening focus on excluding stocks that follow ESG controversies, often referred to as sin stocks. These stocks can include companies involved with alcohol, tobacco, gambling, and defence industries, or companies with poor performance in labour relations or environmental protection. Positive screening, on the other hand, focus on selecting firms that meet superior ESG standards. This method is often combined with a "best in class" approach (Renneboog et al. 2008). Research done by both Hoepner and Schopohl (2016) and Amel-Zadeh and Serafeim (2018) finds that negative screening is the most frequently used method by investors. This, despite a large part of the literature conclude that negative screening financially hurts investors as these excluded sin stocks tend to offer superior financial performance (Hong and Kacperczyk, 2009).

The belief of a significant outperformance by sin stocks is mainly promoted by the early parts of the literature (Hoepner and Schopohl, 2016). From the work of Merton (1987) on neglected stocks he finds two reasons for why neglected stocks should be cheaper than other stocks and hence outperform comparables. Hong and Kacperczyk (2009) used this in their prediction about the effects of social norms on the returns to investing in sin stocks. First, the neglect of the sin stocks by institutional investors will lead to depressed prices of those stocks relative to their fundamental value due to limited risk sharing. This will then give sin stocks higher expected returns than comparables. Second, the increased litigation risk associated with the product of sin companies which is further heightened by social norms, should increase the expected returns of sin stocks.

Based on this literature Derwall et al. (2011) formulated the "shunned-stock hypothesis". This hypothesis says controversial stocks have superior returns because value-driven investors shun and thus push sin stock prices below those of responsible stock, all else equal. It further assumes that by preferring ESG stocks over sin stocks, there will be a shortage of demand for irresponsible assets and/or excess demand for responsible asset, which can affect the behaviour of stock prices. In other words, sin stocks are believed to be undervalued and traded at a discount due to a smaller investor base. This is also supported by Hong and Kacperczyk (2009) study which states that sin stocks are particularly neglected by large institutional investors who are usually obliged to follow strict rules in regard to choosing investable industries. Their research finds that in the period 1980-2006 sin stocks had less institutional ownership than comparable stocks, and this affects the behaviour of the stock prices. Due to sin stocks trading at a discount or being undervalued, they are expected to outperform the market and ESG investors will pay a price for their standards (Stanyer, 2010). Studies of sin stock performance by Fabozzi et al. (2008) and Hong and Kacperczyk (2009) find evidence that that the sin portfolio significantly outperforms common benchmark. These results are in conformity with the shunned-stock hypothesis of Derwall (2011).

On the other side, as stated earlier by UNPRI (2019) to ignore ESG can have an effect on the returns. Derwall et al. (2011) proposed another hypothesis where it is believed that ESG can deliver superior returns, this is called the "errors-in-

expectations hypothesis". In this case the superior returns are due to the fact that the market systematically undervalues the importance of ESG. There are several studies who indicate that companies that use positive screens, with a focus on ESG factors produce superior stock return and positive earnings surprises. ESG is a multidimensional and partially subjective concept, and the lack of tools to measure ESG and their effect on the value of the firm and influence on future cash flows, can contribute to the undervaluing of ESG. Furthermore, much of the economic value created by ESG is often intangible and likely to materialize slowly. It is further hypothesized that the market does not fully incorporate the risks that are associated with unethical corporate practices, thus resulting in unethical companies being overvalued (Derwall et al. 2011).

In contrast, Blitz and Fabozzi (2017) find new compelling evidence that the abnormally high returns of sin stocks can be fully explained by the recently introduced quality factors of Fama and French (2015), profitability and investment. After controlling for these factors, they find no evidence of the existence of a premium specifically to sin stocks. Furthermore, it is argued by Derwall (2011) that the shunned-stock hypothesis and errors-in-expectations hypothesis effect, can cancel each other out and result in a "no net-effect". Which means that the ESG funds and conventional funds earn similar risk-adjusted returns.

Another aspect that is important to highlight is that there is no consensus on which industries should be classified as sin. It is to some degree up to each investors' own moral. Moreover, Blitz and Fabozzi (2017) states that more activities could be classified as sin in the near future, e.g. for-profit prisons, predatory lenders and companies using sweatshops. As mentioned earlier ESG classification of corporations is not that straight forward either. This is due to a wide range of ESG metrics are being used and "noisy" ESG reporting environments. There is also not a definite definition for ESG. As a result, various studies use different definitions, ESG matrices, and also screening, which makes the findings more diverse (Beurden and Gössling, 2008).

In addition, implementation and disclosure of ESG might be related to firm size and industry. Neu et al. (1998) find that firms with a larger market capitalization tend

to provide more environmental disclosures than mid-cap and small-cap firms. A firms' relationship is often intertwined with various stakeholders, and said stakeholders can exert certain pressure that may impact ESG disclosures. Roberts (1992) find that corporate size is related to social responsibility activities, because larger companies are more likely to be scrutinized by both the general public and socially sensitive special interest groups. Larger firms are also more likely to be examined more critically by government regulatory bodies as they are more visible to the public (Chen et al., 2013). This is due to larger firms having more shareholders interested in corporate social activity and are more likely to use formal communication channels to relate results of social endeavours to interested parties (Roberts, 1992). Aguinis and Galavas (2012) further argues that when firm size increases, additional resources and visibility of the firm strengthen the relationship between ESG and outcomes. According to Baumann-Pauly et al. (2013) larger firms are also better structured to promote external communication and reporting ESG performance than smaller firms.

When examining transparency disclosures among industry sectors, there are studies that suggest a positive association between industry membership and social disclosure. Hong and Kacperczyk (2009) find that sin stocks from publicly traded firms that are in the business of alcohol, tobacco, and gambling have higher risk and return, which indicates that social norms affect stock prices and return. If risk reduction is possible through ESG engagement, then ESG could be especially critical for those firms in controversial industries (Jo and Na, 2012). Controversial industries, also called sensitive industries, is a term that includes sinful industries such as tobacco, gambling, alcohol, as well as industries involved with emerging environmental, social, or ethical issues, such as weapons, nuclear, oil, cement, and biotech (Baron et al., 2011). Garcia et al. (2017) find that when controlling for firm size and country, the best environmental performance is predominantly in those companies that are seen as sensitive or as being more likely to cause damage to society. Such findings support the studies on corporate environmental legitimacy for firms from sensitive industries, which tend to disclose their ESG performance to protect their reputation. In similar manner, Palazzo and Richter (2005) argue that although tobacco companies position themselves as good social citizens, the CSR of the tobacco industry may be whitewash or, at best, a strategic approach.

3 Hypotheses

The literature provides mixed empirical evidence on potential financial cost and performance associated with sustainable investments. On one hand, "Sin" companies are expected to have higher return due to lack of risk sharing, neglect from institutional investors, undervalued due to smaller investor base and increased reputational risk (Derwall et al.; 2011 Hong & Kacperczyk, 2009). On the other hand, Derwall et al. (2011) also proposed a theory where it is hypothesized that ESG can deliver superior returns, due to the market systematically undervalues the importance of ESG. Furthermore, Lins, Servaes and Tamayo (2017) find that stock returns of firms with higher social capital, calculated by their CSR intensity, is higher in crisis periods. This is in accordance with the paper of Derwall et al. (2019) where a portfolio of firms with high environmental scores outperforms a portfolio with low scores by 6% per annum over the period 1997-2003.

Therefore, based on earlier empirical research, we want to investigate several aspects of investing in ESG and sin portfolios, with the basis in the question: Does ESG investments come at a cost? First, we will compare the portfolios based on risk-adjusted returns, in order to investigate if any of the portfolios yield abnormal returns or perform better than each other, including the market benchmark. The performance will be measured by the Carhart four-factor model and the Fama-French five-factor model, where we will be able to compare the alphas. Second, we want to investigate the downside risk by applying measures such as Sortino Ratio and VaR, in order to examine if there is more downside risk associated with the SinHK portfolio and the implication a strategy based on ESG investing can have on downside risk. In addition, we will also examine the characteristics of the different portfolios in order to investigate if there are statistical differences and if this can be related to the ESG rating.

4 Methodology

4.1 Formation of ESG and SinHK portfolios

The ESG rating from Refinitiv will be used to rank companies based on their score. This will further be used to create two portfolios consisting of top and bottom 10%. The top 10% portfolio will be referred to as "Virtue" and can resemble a "best-in-class" approach or positive screening method. The bottom 10% is referred to as "Sin". As a third portfolio we will base this on the paper of Hong and Kacperczyk (2009), where the portfolio only consists of sinful industries found on the S&P 500. This portfolio will be referred to as "SinHK". In order to check for any statistical differences between "Virtue" and "Sin" we created a long-short portfolio, where we went long "Virtue" and short "Sin". This portfolio is referred to as "VmS". The return data of "Virtue", "Sin" and "SinHK" portfolios are both equal- and value-weighted, but our main focus will be on the equal-weighted portfolio. In order to capture the changes in ESG scores, the portfolios will be updated annually.

4.2 Risk-Adjusted Return Measure

We use the reward-to-volatility ratio, also known as the Sharpe ratio (Sharpe, 1994), as our risk-adjusted performance measure. The Sharpe ratio is a widely used performance measure for risk-adjusted return and measures the trade-off between excess returns versus the risk-free rate against the riskiness of the portfolio. It is calculated by dividing the excess return over total volatility of the portfolio, where we use the monthly US treasury bill as a proxy for the risk-free rate. The total volatility is the standard deviation of the different portfolios. The Sharpe ratio formula is as follows:

$$Sharpe\ ratio = \frac{Risk\ premium}{Standard\ deviation} = \frac{R_p - R_f}{\sigma_p}$$

The statistical significance of the differences in the Sharpe ratios of the portfolios is then tested using the approach derived by Opdyke (2007).

4.3 Characteristics

We also investigate the characteristics of the four portfolios. The Size, Book-to-Market, profitability and investments. Size is the market capitalization of the individual firms at the end of year t-1. The Book-to-Market is calculated as the value of book equity divided by the market capitalization of the individual firms at year t-1. Profitability is calculated as revenues minus cost of goods sold, minus selling, general and administrative expenses, minus interest expense and divided with book equity at year t-1 (Fama and French, 2015), while investments is calculated as growth in total asset from year t-2 to year t-1. We then obtain the mean values of the firms in each portfolio for each year, before we get the mean values for the period as a whole. The values for market capitalization and accounting data are retrieved from CRSP and Compustat.

4.4 Carhart Four-Factor Model and Fama-French Five Factor Model

In order to evaluate the performance of the different portfolios, we will utilize the Carhart four-factor model and Fama-French five-factor model. The use of factor models has dominated in empirical asset pricing research after Fama and French (1993) revolutionized the field with their three-factor asset pricing model. Fama-French three factor model became an important empirical model in asset pricing, since it explained asset returns better than the classical CAPM model. It consists of excess return on the market, SMB (Small Minus Big) and HML (High Minus Low) factors. Their model was then improved by Carhart (1997) four-factor model where he added a momentum factor (MOM). Fama and French (2015) then improved their own three-factor model with a five-factor model, where the three factors of their original model was extended with Robust Minus Weak (RMW) and Conservative Minus Aggressive (CMA) factors, based on Operating Profit (RMW factor) and Investment (CMA factor).

The original Fama-French (1993) three factor model is the following time-series regression.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + e_{it}$$

Where R_{it} is the return on portfolio i, R_{Ft} is the risk-free return, R_{Mt} is the return on the market portfolio, SMB_t is the return on a well-diversified portfolio of small stocks minus the return on a well-diversified portfolio of big stocks. HML_t is the difference in returns on a well-diversified portfolio of high Book-to-Market stocks versus a well-diversified portfolio of low Book-to-Market stocks. e_{it} is the zero-mean residual. All for period t. (Fama and French, 1993)

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + m_i MOM_t + e_{it}$$

The added factor in Carhart's model is the MOM_t factor, which empirically seems to capture more of the unexplained returns in asset pricing than the three-factor model of Fama and French (1993) did. More specifically, Carhart (1997) showed that the feature of a stock that increased (decreased) last month has a tendency to also increase (decrease) the following month contributed to the explanation of asset pricing returns.

More recently, Fama and French (2015) improved their own three factor model by including two more factors; investments and operating profits

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it}$$

Where RMW_t is the difference between the returns on well diversified portfolios of stocks with robust and weak profitability (Robust Minus Weak). CMA_t is the difference of returns between well diversified portfolios of stocks with low and high investments firms (Conservative Minus Aggressive). Again, all returns for some period t. (Fama and French, 2015)

4.5 Measures of Downside Risk

We also want to investigate how the portfolios are affected by downside risk. We use the Sortiono ratio and value at risk as our measurements of downside risk. The Sortino ratio (Sortino and Price, 1994) is developed from the Sharpe ratio. A drawback of the Sharpe ratio is that it neglects whether the volatility is upside or

downside. Therefore, instead of dividing the excess return over total volatility of the portfolio, the Sortino ratio only takes into account the standard deviation of negative return outcomes, known as lower partial standard deviation (LPSD). The formula for the Sortino ratio is as follows:

$$Sortino\ ratio = \frac{Risk\ premium}{LPSD} = \frac{R_p - R_f}{\sigma_{p_d}}$$

The LPSD takes into account the deviations that a risk averse investor cares about, i.e. the left-tail standard deviation.

In order to get a better view of the data we also test the normality of the dataset. This is done by estimating the skewness and kurtosis. If the skew is positive, (i.e. positively skewed) it indicates that the standard deviation overestimates the risk. If the skew is negative, (i.e. negatively skewed) it indicates that the standard deviation underestimates the risk. Kurtosis measure the degree of fat tails in the return distribution of our portfolios. This means that it measures whether we have more or less of our distribution series far from the centre of the distribution compared to the normal distribution (Bodie, Marcus & Kane, 2014).

Furthermore, we estimate the value at risk (VaR). VaR assess the amount of potential loss and the probability of occurrence for the amount of loss. There are several methods of calculating VaR, but we estimate it based on the empirical distribution of the observed returns. This is done for both the 2.5 and 5 percentiles.

5 Data

5.1 Dataset

The Refinitiv ESG database provides ESG scores from the fiscal year 2002 for approximately 1,000 companies, consisting of mainly U.S. and European companies (Refinitiv, 2020) to approximately 9,000 companies in 2019. When looking at the companies in the US market we discovered that a large proportion of the companies either did not report ESG data or was not covered by Refinitiv. In order to ensure a complete dataset, we limited our scope to the S&P 500 index. The S&P 500 is a suitable representation of the US market, due to the accessibility and it is considered to be a proxy of the US equity market. In addition, the companies on the S&P500 mostly had consistent ESG reporting (S&P U.S Indices, 2020). The preliminary step was to obtain the ESG scores from Refinitiv in Eikon.

However, we still faced several companies who did not report ESG data at all or had incomplete reporting. These were removed from our dataset. With this criterion we retained 450 companies the first year of the sample period, however at the end of the sample period more companies reported ESG data and thus the number of companies in our data sample increased over time. Another criterion for the selection was that the company must be a part of S&P 500 for a whole year. In addition, due to infrequent ESG reporting, we also used annual ESG scores. Refinitiv also allocates a score of zero on the metrics if there is a lack of reporting on metrics relevant to the industry, subsequently worsening the score of companies that are not transparent and encouraging company disclosure.

The monthly stock price of the companies identified in the "Virtue" portfolio and "Sin" portfolio was provided by The Center for Research in Security Prices (CRSP). Here, we obtained the equal weighted as well as the value weighted portfolio. The Small Minus Big (SMB), High Minus Low (HML), Conservative Minus Aggressive (CMA) and Robust Minus Weak (RMW) factors are gathered from the database on the website of Kenneth French[1].

[1] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

5.2 Sample selection

We chose to create and measure the portfolios over a 10-year period from 2010 until the end of 2019 for several reasons. First, during the initial period ESG rating was a relative new concept. Few companies reported ESG data, and the rating agencies can be assumed to be novices with an upward sloping learning curve. Therefore, we assume that both the metrics of the rating agencies and the reporting of ESG data has improved over time. Thus, by starting the sample selection in 2010 we believe that the ESG scores are a better reflection of ESG performance than in the initial period of 2002-2009. Second, by starting the sample in 2010 we avoid to some degree the shock of the global financial crisis of 2007-08.

We want to look at the relationship between the financial performance and ESG score. Therefore, based on the historical S&P 500 constituent list retrieved from Eikon, we selected top and bottom 10% and created the two portfolios, named "Virtue" and "Sin", respectively. Since the number of companies in our dataset varies slightly from year to year, we select the top and bottom 50 companies.

When creating the "SinHK" we based it on what is defined as the Triumvirate of sin described in Hong and Kacperczyk (2009). Since this portfolio is based on industry and not ESG score, we included the companies that did not report ESG scores in the data set as well. The SIC codes were used to classify the stocks on the S&P 500 using Fama-French (1997) 48 industry classification. Industry group 4 (smoke/tobacco) and 5 (beer/alcohol) are classified as sin stocks. However, Fama and French classification scheme does not differentiate between gaming stocks and hotel or entertainment stocks. Therefore, we used NAICS classification to classify these.

5.3 Refinitiv ESG Score

The ESG scores are provided by Refinitiv ESG database through Eikon. The ESG scores are based on the Thomson Reuters financial & risk unit methodology, which became a part of Refinitiv in 2018. It offers a comprehensive ESG database covering over 70% of global market cap, across more than 450 different ESG metrics. The ESG rating methodology is carefully described in the report

environmental, social and governance (ESG) scores from Refinitiv (2020), and we will highlight the key points which are relevant for this thesis. First, based on public reported information the Thomson Reuters ESG rating captures and calculates the companies' performance, commitment and effectiveness of over 450 company-level ESG measures. However, it is a subset of 186 of the most comparable and material per industry that power the overall company assessment and scoring process. These are grouped into 10 categories that reformulate the three pillar scores and the final ESG score. The category scores are rolled up into three pillar scores, namely environmental, social, and corporate governance (Refinitiv, 2020).

Table 1. Refinitiv ESG Categories (Refinitv, 2020)

Pillars	Categories	Themes	
Environmental	Emissions	Emissions Waste	Biodiversity Environmental management system
	Innovation	Product innovation	Green revenues/R&D/capex
	Resource use	Water Sustainable packaging	Energy Environmental supply chain
Social	Community	Community	
	Human rights	Human rights	
	Product responsibility	Responsible marketing Data privacy	Product quality
	Workforce	Diversity and inclusion Working conditions	Career development and training Health and safety
Governance	CSR strategy	CSR strategy	ESG reporting and transparency
	Management	Structure (independence, diversity, committees)	Compensation
	Shareholders	Shareholder rights	Takeover defenses

Secondly, the ESG pillar score is a relative sum of the category weights which vary per industry for the environmental and social categories. For governance, however, the weights remain the same across all industries. Numeric and Boolean metrics are used, and the data points are then converted into numerical values for the percentile score calculation. Previously the ESG scoring methodology allocated a score of 0.5 to companies which didn't report on metrics, essentially giving them the "benefit of the doubt". However, this could have a negative impact on the transparency of a company, disincentivize companies to report on their ESG performance. Today, the

enhanced methodology assigns a score of zero to companies who don't report on metrics relevant to the industry, thus encouraging company disclosure and transparency. Lastly, the percentile score is converted to a letter grade based on the logic in the table below (Refinitiv, 2020).

Table 2. Refinitv ESG Grade (Refinitiv, 2020)

Score range	Grade	Description
0.0 <= score <= 0.083333 0.083333 < score <= 0.166666 0.166666 < score <= 0.250000	D- D D+	"D" score indicates poor relative ESG performance and insufficient degree of transparency in reporting material ESG data publicly.
0.250000 < score <= 0.333333 0.333333 < score <= 0.416666 0.416666 < score <= 0.500000	C- C C+	"C" score indicates satisfactory relative ESG performance and moderate degree of transparency in reporting material ESG data publicly
0.500000 < score <= 0.583333 0.583333 < score <= 0.666666 0.666666 < score <= 0.750000	B- B B+	"B" score indicates good relative ESG performance and above average degree of transparency in reporting material ESG data publicly.
0.750000 < score <= 0.833333 0.833333 < score <= 0.916666 0.916666 < score <= 1	A- A A+	"A" score indicates excellent relative ESG performance and high degree of transparency in reporting material ESG data publicly

5.4 Setting up the model

After completing the stock selection process, we retrieved monthly return data for the sample in the period 01.01.2010 – 31.12.2019. When retrieving return from CRSP it incorporates the dividend into the calculation, where dividends are reinvested in the security at month-end. Thus, reflecting the total return an investor will experience. Furthermore, due to irregular reporting of ESG data and constituent changes, the portfolios were annually reconstructed. This was done on January 1st each year.

The datasets were imported to MATLAB, where we ran the regressions. Excess return was the dependent variable and is defined as the stock return minus the risk-free rate. The monthly measure of risk-free rate is given by the 1-month T-bill provided by Kenneth French. Here, we also retrieved monthly data on excess market return, SMB, HML, MOM, RMW, and CMA in order to run Carhart four factor factor model and Fama-French five factor model.

6 Results and Analysis

6.1 Summary Statistics of Returns

Table 3 Summary Statistics of the Mean Returns, Standard Deviation, and Sharpe Ratio

This table summarizes the mean returns of the portfolios, both monthly and annualized. The standard deviation and the Sortino ratio are measured in monthly periods in order to maximize information content.

Portfolio	Monthly Mean Return	Annual Mean Return	SD	Sharpe Ratio
Virtue	0.01063	0.12760	0.03840	0.26579
Sin	0.01044	0.12522	0.04389	0.22805
SinHK	0.01386	0.16635	0.04025	0.33383
S&P	0.01128	0.13537	0.03598	0.30170

When evaluating the different portfolios, we began with examining the mean returns of the different portfolios Table 3 shows that the mean return of "Virtue" is slightly higher than "Sin", but they are both below that of "S&P". "SinHK", on the other hand, generates a higher return than all the other portfolios. Generating a monthly mean return of 0.323% higher than "Virtue", which on an annual basis is 3.875%. In order to check if the mean returns are statistically different, we performed a simple t-test on the returns of "Virtue" and "Sin". From the results of this test we conclude that the difference in mean return is not statistically different (appendix A). When performing the t-test on the returns of "Virtue" and "SinHK" we also find that the difference in mean returns are not statistically different (appendix A). Furthermore, we observe that "Sin" has the highest standard deviation, followed by "SinHK", indicating that these are more volatile than "Virtue". "S&P" has the lowest standard deviation, this might be due to S&P containing a wider spectre of firms, thus it is possible that "S&P" is more diversified than the other portfolios.

When examining the Sharpe ratio of the different portfolios we find some differences. The Sharpe ratios are all statistically significantly different from zero, meaning that the result indicate a risk-adjusted positive excess return with 95% confidence. All of the portfolios Sharpe ratio are under 1, which can be considered to be suboptimal. The Sharpe ratio of "SinHK" is higher than "Virtue", however, "Virtue" and "Sin" are lower than "S&P". Indicating that "SinHK" has a better

return relative to the risk it has taken on than “Virtue”, “Sin” and “S&P”. Out of all four portfolios, “Sin” has the lowest Sharpe ratio. These findings suggest that “SinHK” is the portfolio with the best performance in regard to standard deviation and risk-adjusted return. Therefore, we also performed statistical test of the differences in the Sharpe ratio, where we tested whether the Sharpe ratio of one portfolio is larger than that of the other with statistical significance (Opdyke, 2007). First, we did not find evidence that the Sharpe ratio of “Virtue” is larger than that of “Sin”, to be of statistical significance (appendix B). Second, the difference in “SinHK” and “Virtue” is also not statistically significant. Finally, the difference between “SinHK” and “S&P” is not of statistical significance (appendix B). Therefore, when it comes to comparing the risk-adjusted returns of the different portfolios, it is difficult to conclude and assess whether the difference in the observed Sharpe ratios are simply an artefact of the market volatility or not. However, the lack of statistical significance of the difference between both the mean returns and the Sharpe ratios, could indicate that this is in fact the case.

6.2 Summary Statistics of the Characteristics

Table 5 Summary Statistics of the Characteristics - Average

	Virtue	Sin	SinHK	S&P
Size	79 139 252 530	14 775 403 082	53 039 587 056	26 899 853 338
B/M	0.3529	0.5278	0.3510	0.3973
Profitability	0.5516	0.4076	1.2158	0.3218
Investments	0.0761	0.5769	0.1388	0.0379

Table 4 Summary Statistics of the Characteristics - Annual

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Virtue	Size	54 938 214 746.5306	67 537 973 656.0085	59 780 489 211.0638	63 021 269 965.5837	82 225 126 337.3171	75 420 736 523.5930	90 635 840 889.9961	87 634 041 701.7300	101 436 172 889.2250	108 762 659 375.0960
	B/M	0.4500	0.1085	0.4443	0.4186	0.3939	0.3732	0.3374	0.3364	0.2650	0.4019
	Profitability	0.4968	0.4434	0.4592	0.4639	0.4087	0.5158	0.4504	0.4799	1.3409	0.4569
	Investments	0.0844	0.1085	0.1064	0.0692	0.0280	0.0133	0.0272	0.1159	0.0590	0.1496
Sin	Size	7 881 984 100.0000	9 955 432 059.8494	10 330 403 151.7613	11 377 489 145.4297	16 252 151 547.1141	18 170 270 579.5157	16 116 321 965.0637	19 358 128 147.0504	19 329 427 046.5927	18 982 423 078.6694
	B/M	0.8458	0.4409	0.6265	0.5793	0.4761	0.4475	0.4278	0.3481	0.4573	0.6283
	Profitability	0.2494	0.6180	0.3556	0.3003	0.2573	0.3918	0.8993	0.3418	0.3585	0.3043
	Investments	0.1220	0.1627	0.1856	0.1082	0.2933	0.2052	0.3580	1.1191	1.1233	2.0919
SinHK	Size	31 325 427 721.1111	39 369 070 471.2500	41 218 725 742.2222	42 412 831 740.0000	49 078 060 059.1022	58 423 174 725.7013	57 115 162 432.8571	76 647 534 670.0000	75 636 488 945.7143	59 169 394 053.0543
	B/M	0.3472	0.8207	0.3166	0.2629	0.2229	0.1277	0.2478	0.4082	0.4062	0.3494
	Profitability	2.1159	0.6142	5.7518	0.4064	0.3882	0.4896	0.6072	0.8066	0.5617	0.4161
	Investments	0.0772	0.0754	-0.0452	0.0773	0.1087	-0.0155	0.3194	0.3280	0.2848	0.1778
S&P	Size	16 563 464 726.6250	19 173 331 971.8858	18 892 426 280.6680	21 434 617 903.2908	27 602 299 805.4655	30 162 952 910.2521	29 642 399 516.3133	32 218 188 273.1498	37 998 919 698.2730	35 309 932 292.7776
	B/M	0.4600	0.4605	0.4871	0.4677	0.3878	0.3531	0.3632	0.3415	0.3080	0.3438
	Profitability	0.3054	0.3278	0.3452	0.3239	0.3194	0.3279	0.3044	0.3102	0.3169	0.3374
	Investments	-0.0343	0.0628	0.0271	0.0740	0.0373	0.0426	0.0265	0.0590	0.0570	0.0267

Since additional characteristics may also be important for stock returns (Lins et al., 2017) we examine size, Book-to-Market, profitability and investment of the four portfolios. The average market size during the period is approximately 79 billion for “Virtue”, 15 billion for “Sin”, 53 billion for “SinHK” and 27 billion for the benchmark portfolio. We find that both “Virtue” and “SinHK” portfolios have, on average, a significantly higher market size than the “Sin” and market portfolio during the period. Furthermore, we also find that the size of “Virtue” portfolio is significantly higher than “SinHK” portfolio and that “Sin” portfolio has a significantly lower size than the benchmark portfolio.

We find that the “Virtue” portfolio has a significantly lower Book-to-Market value than the “Sin portfolio”. The “Sin” portfolio also has a significantly higher Book-to-Market value than both the benchmark and “SinHK” portfolio. The differences in Book-to-Market value between “Virtue”, “SinHK” and the benchmark portfolios are not significantly different from each other at 1, 5 or 10 percent level.

The only significant difference in profitability is the one between the “Virtue” portfolio and “Sin” portfolio, where the “Virtue” portfolio has a significant higher profitability at the 5 percent level. All other differences between the portfolios are not significant at any significance levels.

The differences in investments between the “Virtue” portfolio, “Sin” portfolio and the market portfolio is statistically different at a 5 percent level. More specifically, the “Sin” portfolio is significantly higher than the “Virtue” portfolio and the “Virtue” and “Sin” portfolio is significantly higher than the market portfolio. Furthermore, the value of investments in “SinHK” portfolio is significantly higher than the market portfolio on the 5 percent level and “Sin” portfolio is significantly higher than the “SinHK” portfolio at the 10 percent level.

To conclude, we find that firms in the “Virtue” portfolio have a significantly higher market capitalization, profitability and investment level than the average firm of the S&P 500. The implications with respect to return characteristics is that their level of market capitalization and investments might dampen the returns, while their higher profitability might generate positive returns. The “Sin” portfolio has a

significantly lower market capitalization, but also significantly higher Book-to-Market and investment level than the benchmark. The higher Book-to-Market level and lower market cap might impact their returns positively, while their higher investment level might impact returns negatively. The "SinHK" portfolio has a significantly higher market capitalization and investment level. These characteristics might impact their returns negatively. We also want to highlight the big difference in firm size between the "Virtue" and "Sin" portfolio, which makes us suspect a relationship between ESG score and the size of the firms.

6.2.1 Industry

Table 6 Industry Composition

Virtue

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
2010	0%	10%	0%	2%	0%	2%	0%	0%	4%	0%	2%	6%	6%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%	0%	0%	2%	4%	0%	4%	8%	0%	0%	2%	4%	4%	0%	0%	0%	2%	6%	8%	2%	4%	4%	0%	2%	2%
2011	0%	6%	0%	2%	2%	2%	0%	0%	4%	0%	2%	4%	4%	6%	0%	0%	2%	0%	0%	0%	0%	2%	0%	0%	0%	0%	2%	4%	0%	4%	4%	2%	2%	4%	6%	8%	6%	4%	0%	0%	4%	6%	0%	2%	2%	2%	2%	0%
2012	0%	8%	0%	2%	2%	0%	0%	0%	2%	0%	0%	6%	2%	6%	0%	0%	0%	0%	0%	0%	2%	2%	0%	0%	0%	0%	2%	4%	0%	6%	4%	0%	2%	4%	6%	6%	6%	4%	0%	0%	2%	10%	2%	2%	2%	2%	2%	2%
2013	0%	6%	0%	0%	2%	2%	0%	0%	2%	0%	2%	4%	4%	8%	0%	0%	0%	0%	0%	0%	6%	2%	0%	0%	0%	0%	2%	4%	0%	4%	0%	0%	0%	6%	4%	10%	4%	0%	0%	0%	2%	14%	2%	2%	0%	2%	4%	2%
2014	0%	6%	0%	2%	2%	0%	0%	0%	2%	0%	0%	6%	4%	6%	0%	0%	0%	0%	2%	0%	2%	2%	0%	0%	0%	2%	2%	2%	0%	2%	4%	0%	0%	8%	4%	6%	4%	0%	0%	0%	4%	18%	0%	4%	2%	2%	2%	0%
2015	0%	4%	0%	2%	2%	2%	0%	0%	2%	0%	0%	4%	2%	8%	0%	0%	0%	0%	0%	0%	2%	2%	0%	0%	0%	2%	2%	2%	0%	4%	6%	0%	0%	6%	2%	6%	2%	0%	0%	2%	0%	20%	2%	4%	4%	2%	2%	2%
2016	0%	2%	0%	0%	2%	2%	0%	0%	2%	0%	0%	4%	4%	6%	0%	0%	2%	0%	2%	0%	2%	0%	0%	0%	0%	2%	0%	0%	0%	4%	4%	0%	0%	10%	4%	4%	4%	0%	0%	0%	4%	14%	0%	10%	2%	2%	6%	2%
2017	0%	2%	0%	2%	4%	2%	0%	0%	2%	0%	0%	4%	6%	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%	2%	0%	2%	0%	2%	0%	0%	6%	0%	0%	8%	2%	4%	4%	0%	0%	4%	2%	10%	2%	12%	4%	2%	6%	2%
2018	0%	2%	0%	2%	4%	2%	0%	0%	2%	0%	0%	4%	6%	4%	0%	0%	2%	0%	0%	0%	0%	0%	2%	4%	0%	2%	0%	2%	0%	4%	8%	0%	0%	6%	2%	4%	4%	0%	0%	0%	2%	12%	0%	6%	4%	4%	4%	2%
2019	0%	2%	0%	2%	4%	2%	0%	0%	2%	0%	0%	4%	2%	6%	0%	0%	0%	0%	0%	0%	2%	0%	4%	0%	0%	0%	2%	2%	0%	4%	2%	0%	0%	8%	4%	4%	2%	0%	0%	2%	0%	12%	2%	8%	4%	2%	10%	2%

Sin

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
2010	0%	0%	2%	0%	0%	0%	0%	0%	2%	2%	0%	0%	8%	2%	0%	0%	0%	2%	2%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	6%	2%	2%	6%	12%	2%	10%	2%	0%	2%	6%	2%	8%	2%	2%	2%	0%	8%	0%
2011	0%	2%	2%	0%	0%	0%	2%	0%	2%	2%	0%	0%	6%	2%	0%	0%	0%	0%	2%	0%	4%	0%	0%	0%	0%	2%	0%	0%	0%	12%	2%	8%	4%	4%	0%	12%	2%	0%	2%	4%	2%	8%	2%	0%	2%	0%	10%	0%
2012	0%	2%	0%	0%	0%	0%	2%	0%	2%	0%	0%	2%	6%	2%	0%	0%	0%	2%	4%	0%	4%	2%	0%	0%	0%	2%	0%	0%	0%	14%	2%	10%	4%	6%	0%	4%	2%	0%	2%	4%	4%	6%	2%	0%	0%	0%	10%	0%
2013	0%	2%	2%	0%	0%	0%	2%	0%	2%	0%	0%	2%	4%	0%	0%	0%	0%	2%	2%	0%	2%	2%	4%	0%	0%	0%	0%	0%	0%	14%	0%	8%	4%	4%	2%	4%	6%	0%	0%	6%	2%	2%	2%	4%	2%	0%	14%	0%
2014	0%	0%	2%	0%	2%	0%	2%	0%	2%	0%	0%	0%	10%	0%	0%	0%	0%	2%	4%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	16%	2%	2%	6%	14%	0%	2%	4%	0%	0%	6%	2%	4%	2%	4%	2%	0%	6%	0%
2015	0%	0%	2%	0%	2%	0%	2%	0%	2%	2%	0%	0%	6%	0%	0%	0%	0%	2%	4%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	12%	2%	4%	2%	12%	0%	6%	4%	0%	0%	6%	6%	4%	2%	2%	2%	2%	8%	0%
2016	0%	0%	2%	0%	0%	0%	2%	0%	2%	2%	0%	4%	4%	0%	0%	0%	0%	4%	2%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	10%	0%	4%	4%	12%	2%	4%	6%	2%	0%	6%	6%	6%	2%	0%	4%	0%	6%	0%
2017	0%	2%	2%	2%	0%	0%	2%	2%	0%	2%	2%	4%	2%	0%	0%	0%	0%	4%	0%	0%	4%	0%	0%	2%	0%	0%	0%	0%	0%	8%	0%	2%	4%	14%	2%	6%	6%	0%	0%	6%	6%	2%	0%	0%	2%	0%	12%	0%
2018	0%	0%	2%	0%	0%	0%	2%	0%	0%	2%	0%	6%	0%	0%	2%	0%	0%	6%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%	8%	0%	6%	2%	10%	2%	6%	8%	0%	0%	8%	8%	2%	0%	2%	4%	0%	12%	0%
2019	0%	0%	2%	2%	0%	0%	2%	0%	0%	0%	0%	4%	2%	0%	0%	0%	0%	6%	0%	0%	0%	0%	0%	2%	2%	0%	0%	0%	0%	10%	2%	4%	2%	20%	4%	6%	4%	0%	0%	6%	4%	0%	0%	2%	6%	0%	8%	0%

SinHK

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
2010	0%	0%	0%	45%	36%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%
2011	0%	0%	0%	45%	36%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%
2012	0%	0%	0%	45%	36%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%
2013	0%	0%	0%	45%	36%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%
2014	0%	0%	0%	50%	36%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2015	0%	0%	0%	44%	36%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%
2016	0%	0%	0%	50%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%	0%	0%
2017	0%	0%	0%	50%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%	0%	0%
2018	0%	0%	0%	50%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%	0%	0%
2019	0%	0%	0%	50%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%	0%	0%

1	Agriculture	14	Chems	27	Gold	40	Trans
2	Food	15	Rubbr	28	Mines	41	Whlsl
3	Soda	16	Txtls	29	Coal	42	Rtail
4	Beer	17	BldMt	30	Oil	43	Meals
5	Smoke	18	Cnstr	31	Util	44	Banks
6	Toys	19	Steel	32	Telcm	45	Insur
7	Fun	20	FabPr	33	PerSv	46	RlEst
8	Books	21	Mach	34	BusSv	47	Fin
9	hshld (Consumer goods)	22	ElcEq	35	Comps	48	Othe
10	Clths (Apparel)	23	Autos	36	Chips		
11	Hlth (Healthcare)	24	Aero	37	LabEq		
12	MedEq	25	Ships	38	Paper		
13	Drugs	26	Guns	39	Boxes		

Furthermore, we wanted to examine the portfolios for any structural differences in regard to market industry. In particular, if following an ESG score investment strategy makes one omit certain industries or makes the portfolio less diverse. By applying Fama-French 48 industry composition we were able to identify and compare which industries the three portfolios consist of (Table 6). When examining the portfolios, we discovered some differences in the industry composition. First, as expected "Sin" has a substantially higher proportion invested in the oil industry than "Virtue". On the other hand, "Virtue" has a higher proportion invested in the smoke industry than "Sin", where "Sin" proportion shrank to zero over the years whereas "Virtue" increased. The smoke industry includes tobacco firms, and we find this discovery interesting due to the fact that tobacco is considered a controversial industry. "Virtue" also has a proportion invested in other controversial industries, such as oil, guns, and beer.

This could be explained by the possibility that risk reduction is achievable through ESG engagement, as suggested by (Jo and Na, 2012). A high ESG score of tobacco firms in our portfolio is also in line with Palazzo and Richter (2005) research, where they propose that tobacco companies position themselves as good social citizens, where the high ESG score of the tobacco industry may be whitewash or a strategic approach. Garcia et al. (2017) suggested that the best environmental performance is predominantly in those companies that are seen as sensitive, or as being more likely to cause damage to society. Thus, also offering an explanation to why firms in the other controversial industries have a good ESG performance. However, the fun industry, which is categorized as a sin industry is omitted in the "Virtue" portfolio, and the oil industry has a higher representation in the "Sin" portfolio than "Virtue" portfolio. Therefore, there are some discrepancy between our findings and Garcia et al. (2017), Jo and Na (2012). A possibility is that due to negative screening being the most common ESG investing technique applied by investors (Hoepner and Schopohl, 2016, Amel-Zadeh and Serafeim, 2018) firms in these industries might not focus on ESG because they are most likely to be excluded anyway.

The "SinHK" is a portfolio consisting of only sinful industries, such as alcohol, tobacco and gaming. Therefore, this portfolio consists of companies in the beer, smoke, fun, and meal industry. The reason for the proportion invested in fun and

meal industry is because Fama-French classification scheme does not separate gaming stocks from hotel stocks, which is why we also used used NAICS classification when creating this portfolio. Almost 50% of the SinHK portfolio consist of companies in the beer (alcohol) industry, leaving the portfolio more exposed to volatility in this particular industry.

Both "Virtue" and "Sin" portfolios seem to be composed of companies from different industries, with "Sin" and "Virtue" on average yearly invest in 23 and 26 separate industries, respectively. However, some industries are more overrepresented than others, thus increasing the exposure to said industry and also contribute to an increased idiosyncratic risk attached to the portfolio. Furthermore, it seems that investing based on an ESG strategy might to some degree avoid industry bias, by allowing controversial industries to participate.

6.2.2 ESG and Size

Table 7 Average ESG Score

	Virtue	Sin	SinHK	S&P
2010	80.24	16.18	48.45	47.55
2011	81.31	14.99	50.39	47.74
2012	81.39	16.18	58.15	49.43
2013	80.63	17.52	53.16	50.46
2014	80.66	19.49	50.05	51.29
2015	80.65	22.23	49.86	52.51
2016	82.75	25.88	55.77	55.74
2017	83.66	26.26	60.20	57.50
2018	84.27	28.68	64.93	58.84
2019	84.39	27.83	64.99	59.30

We further investigate the relationship between the distribution of firm size and the ESG score. By looking at the market capitalization of the portfolios we discovered that "Virtue" mainly consists of large-cap firms. In addition, this portfolio only consists of firms with high ESG score. On the other hand, "Sin" which consist of mid-cap firms, has a low ESG score. Therefore, we want to examine the average ESG score of each portfolio over time. From Table 7 we see that in the period 2010 – 2019 the average ESG score of the "Sin" portfolio increased with 72%. The

average market cap of the firms in "Sin" also doubled in size (Table 7). "SinHK" has a market capitalization that is consequently higher than "S&P" each year of the sample period, where subsequently "SinHK" also has a higher ESG score than "S&P". Therefore, we also test the correlation between ESG and size, we did this for the S&P 500 in 2019, in order to limit the time effect. We find that there is a positive correlation between ESG and size (appendix D). These findings are consistent with Neu et al. (1998) where it is proposed that firms with larger market cap (i.e.≥ $10 billion) tend to provide more environmental disclosures than small-cap firms. This can be explained through the stakeholder theory and also due to larger firms being better structured to promote external communication and reporting of ESG performance than smaller firms (Baumann-Pauly et al., 2013).

Therefore, our findings could indicate that as the size of the firm increases, the ESG score also increases. However, it is important to take into account that time also has an impact on both market capitalization and ESG rating. This is due to the increased importance of ESG, inflation and economic growth. Therefore, further investigation ought to be conducted to draw any conclusions. At this point our preliminary findings suggest that to invest in companies with high ESG score may result in a tilt towards large-cap stocks.

6.3 Regressions tests

Table 8 Regressions Results

This table summarizes the empirical abnormal returns, factor loadings, and R^2 of the different portfolios, under the Carhart four-factor model (FFC) and Fama-French five-factor model (FF5). "Virtue" and "Sin" refers to a portfolio containing 10% of top-rated stocks and 10% bottom-rated stocks, respectively. SinHK refers to a portfolio based on the approach of Hong & Kacperczyk (2009), and only contains controversial industries that are considered as sin by Hong and Kacpercz
yk (2009). VmS refers to a portfolio where the dependent variable is the excess return of "Virtue" subtracted the excess return of "Sin". All portfolios are both equal (EW) and value weighted (VW), and the observation period spans from January 2010 to December 2019.

			Alpha	Market	SMB	HML	MOM	RMW	CMA	R-Squared
FFC	EW	Virtue	-0.015505	0.98569***	-0.092928**	0.046133	-0.11025***			0.939
			(0.093581)	(0.026028)	(0.04243)	(0.042305)	(0.030769)			
		Sin	-0.11177	1.0474***	0.17713***	-0.079728	-0.15223***			0.911
			(0.12928)	(0.03597)	(0.058614)	(0.058442)	(0.042506)			
		SinHK	0.34167	0.88737***	-0.42309***	-0.14732	-0.02751			0.586
			(0.25633)	(0.071296)	(0.11622)	(0.11588)	(0.084281)			
		VmS	0.096269	-0.061713	-0.27006***	0.12586*	0.041977			0.175
			(0.16247)	(0.04519)	(0.073666	(0.073449)	(0.053421)			
	VW	Virtue	-0.034892	0.96223***	-0.30077***	0.069726*	-0.038111			0.947
			(0.080962)	(0.22519)	(0.036708	(0.0366)	(0.02662)			
		Sin	-0.15405	1.0436***	0.046396	-0.31797***	-0.019323			0.875
			(0.14716)	(0.040932)	(0.066725)	(0.066528)	(0.048387)			
		SinHK	0.18986	0.79276***	-0.69556***	-0.15014	0.024379			0.477
			(0.28657)	(0.079707)	(0.12993)	(0.12955)	(0.094224)			
		VmS	0.11915	-0.081338	-0.34716***	0.38769***	-0.018788			0.298
			(0.18589)	(0.051704)	(0.084285)	(0.084037)	(0.061121)			
FF5	EW	Virtue	-0.11765	1.0228***	-0.051126	0.045888		0.19588***	0.17447**	0.94
			(0.094501)	(0.026264)	(0.045131)	(0.051562		(0.067719)	(0.08051)	
		Sin	-0.17496	1.0729***	0.15688**	-0.06931		-0.053095	0.1241	0.902
			(0.13765)	(0.038255)	(0.065736)	(0.075103)		(0.098637)	(0.11727)	
		SinHK	0.20432	0.93428***	-0.30265**	-0.15222		0.53273***	0.1775	0.62
			(0.24962)	(0.069376)	(0.11921)	(0.1362)		(0.17888)	(0.21266)	
		VmS	0.057306	-0.050033	-0.20801***	0.1152		0.24897**	0.050363	0.203
			(0.16223)	(0.045087)	(0.077475	(0.088515)		(0.11625)	(0.13821)	
	VW	Virtue	-0.084106	0.98175***	-0.26333***	0.11167**		0.17088***	0.036371	0.95
			(0.079752)	(0.022165)	(0.038087)	(0.043515)		(0.057115)	(0.067945)	
		Sin	-0.11904	1.0345***	0.00033973	-0.28578***		-0.16972	-0.066355	0.878
			(0.14767)	(0.04104)	(0.070521)	(0.08057)		(0.10582)	(0.1258)	
		SinHK	-0.03816	0.86859***	-0.53859***	-0.34499**		0.69822***	0.65256***	0.569
			(0.26416)	(0.073418)	(0.12616)	(0.14413)		(0.1893)	(0.22505)	
		VmS	0.034932	-0.052711	-0.26367***	0.39745***		0.3406**	0.102773	0.337
			(0.18345)	(0.050986)	(0.087612)	(0.1001)		(0.13146)	(0.15629)	

*** Indicates significance on a 1% confidence level
** Indicates significance on a 5% confidence level
* Indicates significance on a 10% confidence level

Table 8 presents the results of our portfolios based on ESG rating strategy and the approach of Hong and Kacperczyk (2009). Starting with the Carhart four-factor model we spot a negative alpha in both the "Virtue" and "Sin" portfolio and a positive for "SinHK" and "VmS". However, neither of these alphas are statistically significant on any conventional level and can therefore not be used to draw any conclusions regarding performance. This applies for both the equal-weighted and value-weighted portfolios. Our preliminary findings, therefore, suggest that there are no statistically significant positive abnormal returns generated by investing based on ESG scores and controversial industries. From the insignificance of the alpha in "VmS" we can also conclude, based on our preliminary findings, that there is no statistically difference in the alphas between "Virtue" and "Sin".

Furthermore, "Sin" has a higher market beta than "Virtue", which indicates that the companies with low ESG score might have a higher systematic risk on average, than companies with a high ESG score. The market beta is also higher than 1, indicating that this portfolio is more volatile than the market. These are significant on a 1% confidence level. "SinHK" has a lower market beta than both "Virtue" and "Sin", suggesting that controversial industries yield less volatile returns and might also have lower systematic risk than the other portfolios. Which is in accordance with Hong and Kacperczyk (2009) findings, where they find that beer and smoke industries appear to have lower betas than other industries.

When looking at the SMB factor we observe that "Sin" is positively correlated at a 1% confidence level. With $\beta\_SMB\_ > 0$ it can indicate that the portfolio predominantly consists of small-cap stocks, which means that if small-cap stocks outperform large-cap stock we can expect higher return. However, Chen and Basset (2014) find that a positive beta does not necessarily mean that the portfolio consist of small-cap stocks, due to the minus big (SMB) factor is actually small relative to the whole market and hence could lead to a biased positive SMB estimate. On the other hand, "Virtue" has a negative correlation with the SMB factor on a 5% level, indicating that this portfolio predominantly consists of large-cap stocks, meaning that if large firms outperform small firms, we get a higher expected return. This is also the case for "SinHK", however, it has a higher factor loading than "Virtue". Due to the significant difference in the SMB factor for "Sin" and "Virtue", we

looked into the average market capitalization of the firms in each portfolio presented earlier in Table 5. We observe a distinct difference between the three portfolios. “Virtue” has a market capitalization of 79 billion, “SinHK” has a market capitalization of 53 billion, while “Sin” has 15 billion in market capitalization. These findings support that “Virtue” and “SinHK” mainly consist of large-cap stocks. On the other hand, we find that “Sin” mainly consists of large- and mid-cap stocks (i e. rule of thumb \$2 billion < mid-cap < \$10 billion). This opposes the indication given by the positive SMB coefficient. However, the positive coefficient can occur because the portfolio is “small”, compared to the overall market, which is consistent with Chen and Besset (2014) research.

We did not get any statistically significant results for the HML factor and can thus not draw any conclusion concerning this factor. MOM, however, is statistically significant for both “Virtue” and “Sin” on a 1% level, but not “SinHK. “Virtue” and “Sin” are negatively correlated with the MOM factor with “Sin” being slightly more negative. These results oppose the conclusion of the momentum factor in the Carhart four-factor model.

When applying the Fama-French five-factor model, the alpha of the portfolios still remains negative and insignificant, both for the equal-weighted and value-weighted portfolios. The market beta increased for the “Virtue” and “Sin” portfolio, indicating that they are both more volatile than the market. “SinHK”, on the other hand, also had an increase in the market beta but is still below 1. We observe a slight increase for the correlation with SMB in “Sin”, whereas “Virtue” no longer has a statistically significant exposure to SMB. “SinHK” is still statistically significant but has slight decrease in the factor loading. When introducing the two new factors, “Sin” did not have any statistically significant results, but “Virtue” on the other hand did. “Virtue” has a positive exposure to RMW and CMA, that is, it indicates that their return behaves like those of profitable firms that invest conservatively. “SinHK” only has a positive statistically significant relationship to RMW, indicating the returns reflect the behaviour of firms with high profitability.

Contrary to the research done by Derwall et al. (2011), we are not able at this point to find significantly positive alpha by using firms ESG score with neither of the

models. We only observe a marginal model improvement as we go from the FFC to the FF5 in the "Virtue" and "SinHK" portfolio. "Sin", on the other hand, has a slight worsening in the explanatory power. The last two factors, RMW and CMA, seemingly add little extra explanatory power to the already existing model of the market, size and momentum factors. This contradicts the results achieved by Blitz and Fabozzi (2017) that returns of sin stocks can be fully explained by the two new factors in FF5, RMW and CMA. We can, however, not conclude whether the RMW and CMA factors are weak alone, or if the information they exhibit is already explained by other factors.

6.4 Downside Risk

Table 9 Downside Risk Characteristics

This table summarizes the monthly lower partial standard deviation (LPSD), and the monthly Sortino ratio. The 5- and 2.5% VaR are based on the empirical distribution of the actual portfolio returns.

Portfolio	LPSD	Sortino Ratio	5% VaR	2.5% VaR	Skewness	Kurtosis
Virtue	0.0255	0.3999	-0.0603	-0.0726	-0.2122	3.3086
Sin	0.0300	0.3338	-0.0688	-0.0866	-0.1202	4.0832
SinHK	0.0246	0.5473	-0.0579	-0.0611	-0.2320	3.3749
S&P	0.0244	0.3620	-0.0601	-0.0702	-0.3617	3.5462

We evaluated the portfolios based on different downside risk measures, presented in Table 9. A limitation to Sharpe ratio applied earlier, is that the standard deviation includes both positive and negative volatility, thus in a way punish the investment for good risk. In order to separate the downside volatility from the overall total volatility we applied the Sortino ratio, which only takes into account the returns of the left-tail of our distribution, and thus incorporated the increased risk that is caused by negatively skewed returns better. We discovered that "Virtue" has a higher Sortino ratio than "Sin", meaning that "Virtue" is earning more return per unit of the bad risk it takes on. On the other hand, "SinHK" has a notably higher Sortino ratio than "Virtue", indicating that this portfolio has an even better return per unit bad risk than "Virtue". The only portfolio with a lower Sortino ratio than "S&P" is "Sin", we also observe that this portfolio has a higher LPSD than the other portfolios and the lowest monthly mean returns. Suggesting that it to some degree

underperforms the other portfolios, but also the market. Both "SinHK" and "Virtue" have a LPSD that is slightly higher than "S&P", thus indicating that they have slightly more bad volatility than the market.

When evaluating the skewness and kurtosis for the portfolios, we find that they have a kurtosis higher than three and a skewness below zero (Table 9). Thus, indicating that the distribution deviates from a normal distribution, with them having a negative skew and fat tails. This was one of the reasons why we computed the VaR based on the empirical distribution of the actual portfolio returns. The results from skew and kurtosis also indicates that there could be some outliers in our data.

From both the 5% VaR and the 2.5% VaR we observe that "SinHK" has the lowest value at risk. With a 5% and 2.5% chance of losing more than 5.79% and 6.11% of its value, respectively. Again, as expected, "Sin" has the highest VaR, both at a 5% and a 2.5% level. "Virtue" has a higher VaR than "S&P", however the difference is only marginal at a 5% level and slightly larger at a 2.5% level.

These findings are in conformity with the results obtained by Lins et al. (2017), where firms with high ESG score performs better than firms with low ESG score. Lins et al. (2017); Derwall et al. (2019). From Table 8 we also observed a lower market beta for "Virtue" than "Sin", which is in line with Albuquerque et al. (2019) findings, where CSR leads to lower systematic risk. On the other hand, we also find some evidence supporting the paper of Hong and Kacperczyk (2009). Our "SinHK" has the highest risk-adjusted return out of all our portfolios. However, as mentioned earlier, this is not statistically different from that of "Virtue" and "S&P". One aspect of our findings that stands out, is that the "SinHK" portfolio has the lowest VaR on both 5% and 2.5% level, and the best Sortino ratio, indicating that for each unit bad risk it undertakes, it generates more return than the other portfolios. This is in line with Hong and Kacperczyk (2009) and Derwall et al. (2011). Thus, also supporting the shunned-stock hypothesis. We do not, however, find evidence supporting the "errors-in-expectations hypothesis" by Derwall (2011), where it is proposed that superior returns are due to the market systematically undervalue the importance of ESG. What we do find, is that the "Virtue" portfolio has less volatility and behaves

similar to the market benchmark. Thus, indicating that firms with a high ESG score, are less volatile.

In addition to this, the efficient market hypothesis might account for the lack of generating alpha in the "Virtue", "Sin" and "SinHK" portfolio. The hypothesis states that if everyone have the same access to information and possesses the ability to trade with the same efficiency, it is extremely difficult for anyone to beat the market. In other words, in a semi-strong efficient market, all information publicly available to investors are reflected in the current stock prices. Thus, one cannot expect to systematically generate abnormal returns above the market benchmark.

7 Robustness Tests and Limitations

7.1 Robustness Test

Table 10 Regression Results Sub-Sample

			Alpha	Market	SMB	HML	MOM	RMW	CMA	R-Squared
FFC	1	Virtue	-0.00079455	0.90969***	0.13163*	0.082547	-0.007964			0.973
			(0.12541)	(0.033949)	(0.074293)	(0.064759)	(0.043551)			
		Sin	0.15418	1.1102***	0.25214*	-0.029414	-0.099908			0.948
			(0.21697)	(0.058734)	(0.12853)	(0.075346)	(0.075346)			
		SinHK	0.81904*	0.81086***	-0.086233	-0.28077	0.24936*			0.686
			(0.40901)	(0.11072)	(0.2423)	(0.21121)	(0.14204)			
		VmS	-0.15497	-0.20049***	-0.12051	0.11196	0.091944			0.359
			(0.24264)	(0.065684)	(0.14374)	(0.12529)	(0.084261)			
	2	Virtue	0.0000046771	1.0096***	-0.17542**	-0.046536	-0.16031***			0.93
			(0.16441)	(0.052351)	(0.068789)	(0.10032)	(0.058428)			
		Sin	-0.066784	0.97691***	0.16861*	-0.18308	-0.249***			0.887
			(0.22516)	(0.071694)	(0.094206)	(0.13739)	(0.080017)			
		SinHK	0.54142	0.90256***	-0.62904***	-0.07347	0.14559			0.684
			(0.34985)	(0.1114)	(0.14638)	(0.21347)	(0.12433)			
		VmS	0.06683	0.032651	-0.34403***	0.13654	0.088686			0.192
			(0.30011)	(0.09556)	(0.12557)	(0.18312)	(0.10665)			
	3	Virtue	-0.042927	0.96732***	-0.14411*	-0.0067863	-0.21446***			0.933
			(0.17818	(0.054923)	(0.073058)	(0.07087)	(0.067336)			
		Sin	-0.40305	0.7829***	-0.57122***	-0.42669**	-0.62574***			0.674
			(0.457)	(0.14087)	(0.18738)	(0.18176)	(0.1727)			
		SinHK	-0.40305	0.7829***	-0.57122***	-0.42669**	-0.62574***			0.674
			(0.457)	(0.14087)	(0.18738)	(0.18176)	(0.1727)			
		VmS	0.30778	0.047669	-0.25869**	0.20561*	0.063833			0.179
			(0.29612)	(0.091276)	(0.12142)	(0.11778)	(0.11191)			
FF5	1	Virtue	-0.02819	0.91833***	0.12957*	0.085631		0.054797	0.0089229	0.973
			(0.14267)	(0.038673)	(0.07479)	(0.093007)		(0.62471)	(0.12632)	
		Sin	0.36041	1.0782***	0.28232**	0.043978		-0.18545	-0.39536*	0.953
			(0.23538)	(0.063805)	(0.12339)	(0.15345)		(0.18313)	(0.20841)	
		SinHK	0.60793	0.8764***	-0.067575	-0.24157		0.50744	0.35642	0.686
			(0.4678)	(0.12681)	(0.24523)	(0.30496)		(0.36396)	(0.41419)	
		VmS	-0.3886	-0.15984**	-0.15275	0.041653		0.23025	0.40428	0.423
			(0.26323)	(0.071355)	(0.13799)	(0.17161)		(0.2048)	(0.23307)	
	2	Virtue	-0.059985	1.0788***	-0.053808	-0.030197		0.25878**	0.3753**	0.946
			(0.14749)	(0.04494)	(0.069801)	(0.09242)		(0.10877)	(0.15347)	
		Sin	-0.17592	1.0497***	0.14859	0.0666701		0.051751	-0.0093869	0.854
			(0.26037)	(0.079336)	(0.12323)	(0.16316)		(0.19203)	(0.27094)	
		SinHK	0.62052*	0.89466***	-0.51216***	-0.38357*		0.17754	0.51324	0.714
			(0.33962)	(0.10348)	(0.16073)	(0.21283)		(0.25048)	(0.3534)	
		VmS	0.11593	0.029106	-0.2024	-0.096898		0.20703	0.38468	0.248
			(0.29511)	(0.089923)	(0.13967)	0.18494)		(0.21765)	(0.30709)	
	3	Virtue	-0.11131	1.0716***	-0.1501	0.081407		-0.06025	0.16336	0.916
			(0.20317)	(0.064064)	(0.097798)	(0.098319)		(0.18836)	(0.1702)	
		Sin	-0.602	0.9053***	-0.28152	0.035619		0.73043	-0.28009	0.586
			(0.52625)	(0.16594)	(0.25332)	(0.25467)		(0.48789)	(0.44085)	
		SinHK	-0.602	0.9053***	-0.28152	0.035619		0.73043	-0.28009	0.586
			(0.52625)	(0.16594)	(0.25332)	(0.25467)		(0.48789)	(0.44085)	
		VmS	0.35977	0.020421	-0.31725**	0.2978**		-0.16945	-0.18558	0.202
			(0.29839)	(0.094091)	(0.14364)	(0.1444)		(0.27664)	(0.24997)	

*** Indicates significance on a 1% confidence level
** Indicates significance on a 5% confidence level
* Indicates significance on a 10% confidence level

As a robustness test, we divided the period into three sub-periods consisting of 40 months of return data each. We then ran the tests of our portfolios with these sub-periods to see if our results changed to any significant degree. The results can be seen in Table 10 and are mainly consistent with our baseline model. The results show that neither our "Virtue" portfolio nor our "Sin" portfolio gives superior performance compared to the S&P500 index when we run them on our sub-periods. The results of the "SinHK" portfolio is also in line with our original results, except for the alpha being positive and significant in the first sub-period in our FFC test and in the second sub-period in our FF5 test.

7.1.1 Virtue Portfolio

From Table 10 we can see that for the "Virtue" portfolio, the market beta is significant at a 1 percent level, both when we estimate FFC and FF5, in all our sub-periods. The market beta is lower than 1 in the first and third sub-period in the FFC and in the first sub-period in the FF5. The market beta is higher than 1 in the second sub-period in the FFC and in the second and third sub-period in the FF5 test. In FFC, the SMB factor is positive and significant at 10 percent level in the first sub-period and negative and significant at 5 and 10 percent level sub-period 2 and 3. For FF5, the SMB factor is only significant and positive in the first sub-period. The HML factor is not significant at any sub-periods in both FFC and FF5. The MOM factor is significant at 1 percent level and negative in the second and third sub-period, but insignificant in the first sub-period. The RMW and CMA factors are positive and significant at 5 percent level only in the second sub-period.

7.1.2 Sin Portfolio

When examining the "Sin" portfolio, the market beta is significant at 1 percent level in all sub-periods in both FFC and FF5. In Carhart, the factor is significantly higher than 1 in sub-period 1 and significantly lower than 1 in sub-period 2 and 3 in FFC. In FF5, the factor is in significantly lower than 1 in sub-period 3 in FF5. In the other sub-periods, the market beta is higher than 1. The SMB factor is significant in all sub-periods in FFC, but only significant in the first sub-period in FF5. In FFC, the factor is positive and significant at 10 percent level in sub-periods 1 and 2, while the factor is negative and significant at 1 percent level in sub-period 3. In FF5, the factor is only significant at 5 percent level and positive in the first sub-period. The HML factor is only negative and significant at 5 percent level in the third sub-period

in FFC. The factor is insignificant at all sub-periods in FF5 and in the first and second sub-period in FFC. The MOM factor is negative and highly significant in the second and third sub-period, but insignificant in the first sub-period. The RMW factor is significant at all levels in all sub-periods, while the CMA factor is only negative and significant at 10 percent level in the first sub-period.

7.1.3 SinHK Portfolio

The market beta for the "SinHK" portfolio is significantly lower than 1 in all our sub-periods, both for FFC and FF5. The SMB factor is significantly negative at the 1 percent level in the first and second sub-period of FFC, while it is significantly negative at the 1 percent level in the second sub-period of the FF5. The factor is negative, but insignificant, at all other sub-periods in FFC and FF5. The HML factor is significantly negative only in the last sub-period of FFC, while it is only significantly negative at 10 percent level in the second sub-period of FF5. The MOM factor is significantly positive at 10 percent level in the first sub-period and significantly negative at 1 percent in the last sub-period. The RMW and CMA factors are all insignificant in all the sub-periods.

7.1.4 Long Virtue-Short Sin portfolio

In the "VmS" portfolio we only care about the alpha factor, which is insignificant at all levels, in all sub-periods, in both FFC and FF5. This is in line with our original results and we cannot conclude that it is possible to obtain significant excess returns by going long the "Virtue" portfolio and short the "Sin" portfolio, neither for the period overall nor in the sub-periods. Our results also show that we cannot conclude that there is any difference in returns between the "Virtue" portfolio and the "Sin" portfolio.

7.2 Limitations

A common dilemma from applying ESG scores as an investment strategy is that the ratings are different dependent on which rating agency is used. One rating agency can give a high score to a firm, while another rating agency gives the same firm a low score. This happens because the ESG score depends on which factors the rating agencies focus on and how they weight the different factors. This means that using

the ESG score from one rating agency can bias our results and make them different than if we used the ESG score from other rating agency. This limitation is difficult to fully correct, but one possible solution to partially correct it is to incorporate ESG scores from several rating agencies to make the results more robust.

Another potential limitation of our paper is that we have not investigated the impact outliers have on our results. As mentioned earlier, our calculations of skew and kurtosis indicates that there are outliers in our data, but as a general rule the outliers should not be removed without a probable cause. We have tried to take this into account with our downside risk calculations of 2.5 and 5 percent Value-at-Risk, but these outliers might also impact our statistical tests. More specifically, outliers can impact our data by biasing our portfolio returns through extreme returns in some of the firms included in the portfolio. Investigating the outliers might give probable cause of removing them.

There are some potential problems that arise from the imperfect coverage of companies in Refinitiv. Therefore, we also risk that our ESG data from Refinitiv in reality measures something else than actual ESG performance, and thus our data can be influenced by sample selection bias. As mentioned earlier, we suspect that the ESG rating correlates with firm size. The correlation between ESG rating and firm size has been indicated from the firm characteristics, and further highlighted in the correlation plots of S&P 500 for 2019 in Appendix E. If this is the case, then there is a possibility that a high ESG score might not reflect actual improved ESG performance, but better reporting. This could be due to larger firms being better structured to promote external communication and reporting of ESG performance than smaller firms (Baumann-Pauly et al., 2013), but also increased pressure from stakeholders. One possible solution to this problem would be to use a proxy for ESG rating and create portfolios based on the proxy. As long as this proxy is only based on objective measures not influenced by firm size or ESG reporting conditions, using the proxy gives us the opportunity to obtain ESG data that is more valid than ESG rating scores. Unfortunately, we have not been able to find a suitable proxy that covers enough of the ESG characteristics.

8 Conclusion

In this thesis we examined the relationship between ESG scores and financial performance at a more recent time period. We limited our scope to the stock universe of S&P 500, where we applied the new improved Refinitiv ESG score as a screening tool for the creation of our portfolios. Additionally, we used Fama-French classification scheme to create the "SinHK" portfolio based on Hong and Kacperczyk's (2009) paper. In accordance with the mixed empirical evidence reported in the literature review, we find mixed evidence of the relationship between ESG scores and financial performance.

We were unable to systematically generate positive abnormal return on a strategy based on ESG score. The "Virtue" portfolio has a better risk-adjusted return than the "Sin" portfolio, however neither of these outperformed the market benchmark. In addition, the differences in the mean returns and Sharpe ration between "Virtue" and "Sin" is also not statistically significant. Furthermore, the "VmS" (i.e. long Virtue-short Sin) does not generate a significant alpha in neither FFC nor FF5. Therefore, our evidence does not support the hypothesis of Lins et al. (2017); Derwall et. al. (2019), suggesting that firms with high ESG rating outperform firms with low ESG rating, and the "errors-in-expectations" hypothesis (Derwall et al. 2011). We do, however, find that "Virtue" has a lower VaR and higher Sortino ratio than "Sin", thus supporting the hypothesis that it might be possible to reduce risk through ESG engagement (Jo and Na, 2012).

Furthermore, our "SinHK" portfolio did not generate any significant alpha, or statistically significant different mean return from "S&P" and "Virtue". Therefore, we find no evidence suggesting stocks are undervalued or, has depressed prices due to limited risk sharing, thus opposing to some degree the findings of Hong and Kacperczyk (2009) and Derwall (2011). We did, however, find a significant alpha when we performed a sub-sample analysis, thus questioning the robustness of this test. Our findings also indicate that there is more risk associated with a portfolio consisting of firms in the sin industry, and we also find that this portfolio also has lower systematic risk, which is in accordance with Hong and Kacperczyk (2009).

Our findings might be explained by the "no-net-effect" where the "shunned-stock" hypothesis and "errors-in-expectations" hypothesis effect cancel each other out, resulting in "Virtue" and "SinHK" portfolio earning similar risk-adjusted returns.

Furthermore, our findings suggest that using ESG score as an investment criterion might result in a tilt on size. We observe a relationship between ESG score and firm size. Our "Virtue" and "Sin" portfolio predominantly consist of large-cap firms and mid-cap firms, respectively. Thus, supporting literature such as Neu et al. (1998) that firms with a larger market capitalization tend to provide more environmental disclosure than mid-cap and small-cap firms. We also observe that as the "Sin" portfolio doubled in size from 2010-2019 the average ESG score of firms in this portfolio also increased by 72%, which is in line with Auginis and Galavas (2012) research. This could be caused by several reasons, such as the stakeholder theory, increase in resources and visibility, and better structure in order to promote external communication and reporting of ESG. This also explains why "Virtue" consist of large-cap firms.

We also observe that investing based on an ESG strategy might to some degree avoid industry bias, by allowing controversial industries to participate. Moreover, we also find that tobacco firms which belongs to the sin industries received a high ESG score, thus supporting the hypothesis that the best environmental performance is predominantly in companies that are sensitive (Garcia et al., 2017), and the effect firm size may have on ESG (Neu et al. 1998; Baumann-Pauly et al., 2013). However, it is possible that this enhanced ESG rating might just be a strategic approach or whitewash in order to protect their reputation (Palazzo and Richter, 2005).

Lastly, our findings suggest that an investment strategy based on ESG rating can result in a cost. We find some evidence indicating that to invest in companies with high ESG score may result in a tilt towards large-cap stocks, and additionally a loss of diversification. This is due to a large-cap bias and the decreased number of stocks in the universe and thus increased correlation of each stock. On the other hand, it is possible that through ESG engagement one migh decrease the average stock's specific risk. As we observed, the "Virtue" portfolio has a lower LPSD and VaR than "Sin".

We propose a few possible directions for further research in this area. As our results indicate that ESG rating is associated with firm size, one possible avenue for future research can be to investigate the link of large cap bias present in our data. As mentioned in the limitation part, there is a possibility that high ESG score might come from better reporting rather than better performance, we therefore suggest that other studies can control for ESG reporting standards.

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9. Appendices

A – t -Test

t-Test: Two-Sample Assuming Unequal Variances

	Virtue	*Sin*
Mean	0.01020667	0.0138625
Variance	0.0014767	0.0016199
Observations	120	120
Hypothesized Mean Difference	0	
df	237	
t Stat	-0.7196722	
P(T<=t) one-tail	0.23621797	
t Critical one-tail	1.65130839	
P(T<=t) two-tail	0.47243595	
t Critical two-tail	1.97002401	

t-Test: Two-Sample Assuming Unequal Variances

	Virtue	*S&P*
Mean	0.01020667	0.01085417
Variance	0.0014767	0.001295
Observations	120	120
Hypothesized Mean Difference	0	
df	237	
t Stat	-0.1347279	
P(T<=t) one-tail	0.44647066	
t Critical one-tail	1.65130839	
P(T<=t) two-tail	0.89294133	
t Critical two-tail	1.97002401	

t-Test: Two-Sample Assuming Unequal Variances

	SinHK	*S&P*
Mean	0.01343583	0.01085417
Variance	0.00162693	0.001295
Observations	120	120
Hypothesized Mean Difference	0	
df	235	
t Stat	0.52318575	
P(T<=t) one-tail	0.30066898	
t Critical one-tail	1.65136354	
P(T<=t) two-tail	0.60133795	
t Critical two-tail	1.97011006	

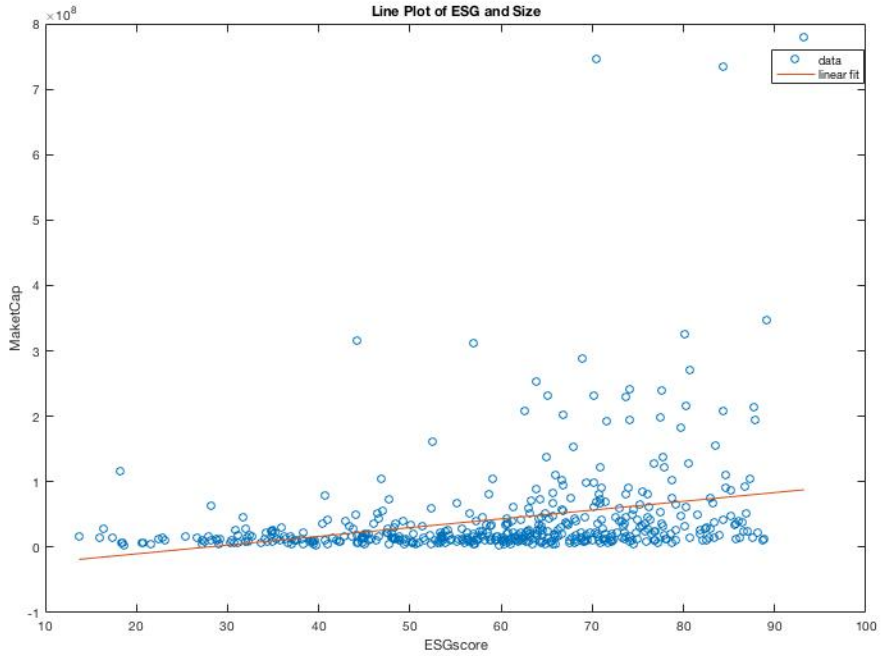
B – Significance Test of Sharpe Ratio

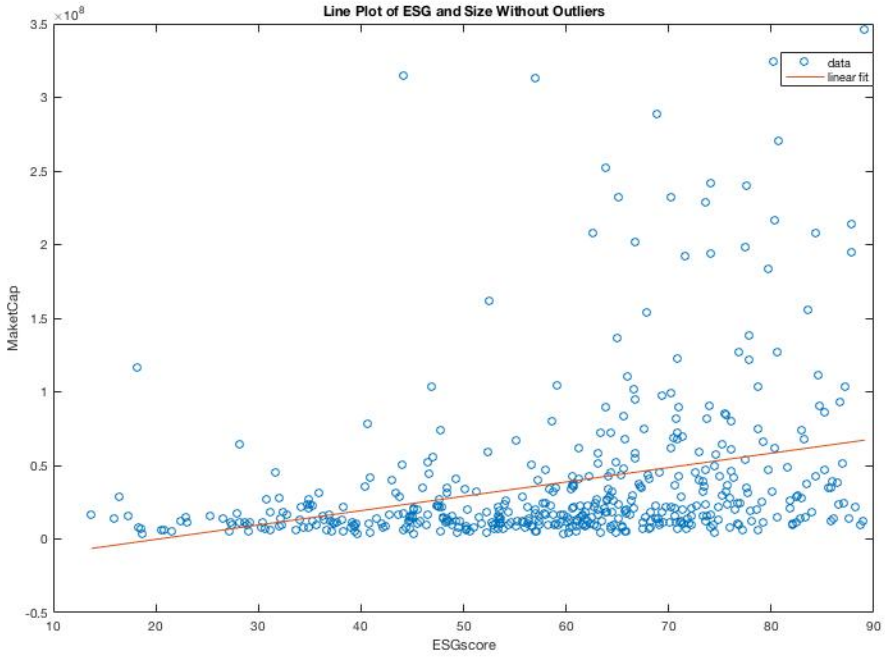
	2-tailed p-value H0: SRA = 0	1-tailed p-value H0: SRA ≤ 0	2-tailed p-value H0: (SRB-SRA)=0	1-tailed p-value H0: (SRB-SRA)≤0
Virtue	0.0058	0.0029		
Sin	0.0167	0.0083		
SinHK	0.0007	0.0004		
S&P	0.0024	0.0012		
SinHK (SRB) > Virtue(SRA)			0.4329	0.2164
SinHK (SRB) > S&P (SRA)			0.7202	0.3601
Virtue(SRB) > Sin (SRA)			0.5322	0.2661

C – t -Test Firm Characteristics

	VmS	VmSP	SmSP	VmSHK	SHKmSP	SmSHK
Size	0.0000	0.0000	0.0005	0.0027	0.0003	0.0000
B/M	0.0065	0.2658	0.0223	0.9773	0.4737	0.0299
Profitability	0.2039	0.0285	0.2119	0.2456	0.1256	0.1630
Investments	0.0398	0.0399	0.0294	0.1881	0.0426	0.0670

D – Correlation Between ESG and Size





E - List of Firms in Sin Portfolio

2010	2011	2012	2013	2014	2015
3M Co	3M Co	3M Co	3M Co	3M Co	3M Co
Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Agilent Technologies Inc
Allstate Corp	Agilent Technologies Inc	Agilent Technologies Inc	Agilent Technologies Inc	Agilent Technologies Inc	Air Products and Chemicals Inc
American Electric Power Company Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Allstate Corp
Baxter International Inc	Allstate Corp	Allstate Corp	Altria Group Inc	Allstate Corp	Altria Group Inc
Becton Dickinson and Co	Altria Group Inc	Altria Group Inc	Analog Devices Inc	Altria Group Inc	Autodesk Inc
Campbell Soup Co	Analog Devices Inc	Avery Dennison Corp	Autodesk Inc	Analog Devices Inc	Baker Hughes Co
Cisco Systems Inc	Avery Dennison Corp	Baker Hughes Co	Baker Hughes Co	Autodesk Inc	Becton Dickinson and Co
Cleveland-Cliffs Inc	Baxter International Inc	Baxter International Inc	Baxter International Inc	Baker Hughes Co	Best Buy Co Inc
Coca-Cola Co	Campbell Soup Co	Becton Dickinson and Co	Campbell Soup Co	Baxter International Inc	Campbell Soup Co
Coca-Cola European Partners PLC	CBRE Group Inc	Campbell Soup Co	Caterpillar Inc	CA Inc	CBRE Group Inc
Colgate-Palmolive Co	Cisco Systems Inc	CBRE Group Inc	CBRE Group Inc	Campbell Soup Co	Cisco Systems Inc
Conagra Brands Inc	Citigroup Inc	Chevron Corp	Chevron Corp	Caterpillar Inc	Colgate-Palmolive Co
ConocoPhillips	Cleveland-Cliffs Inc	Cisco Systems Inc	Cisco Systems Inc	CBRE Group Inc	ConocoPhillips
Consolidated Edison Inc	Coca-Cola Co	Cleveland-Cliffs Inc	Cleveland-Cliffs Inc	Cisco Systems Inc	Cummins Inc
CVS Health Corp	Colgate-Palmolive Co	Colgate-Palmolive Co	Colgate-Palmolive Co	Citigroup Inc	CVS Health Corp
Dow Chemical Co	ConocoPhillips	Conagra Brands Inc	Conagra Brands Inc	Coca-Cola Co	Dow Chemical Co
E I Du Pont De Nemours and Co	CVS Health Corp	ConocoPhillips	ConocoPhillips	Colgate-Palmolive Co	Duke Energy Corp
Exxon Mobil Corp	Dow Chemical Co	CVS Health Corp	Cummins Inc	Conagra Brands Inc	E I Du Pont De Nemours and Co
Freeport-McMoRan Inc	E I Du Pont De Nemours and Co	Dell Inc	CVS Health Corp	ConocoPhillips	FedEx Corp
Gap Inc	Exxon Mobil Corp	Dow Chemical Co	Dell Inc	Cummins Inc	Freeport-McMoRan Inc
General Electric Co	Freeport-McMoRan Inc	Duke Energy Corp	Dow Chemical Co	CVS Health Corp	Gap Inc
General Mills Inc	Gap Inc	E I Du Pont De Nemours and Co	E I Du Pont De Nemours and Co	Dow Chemical Co	General Electric Co
Hershey Co	General Electric Co	Entergy Corp	Exxon Mobil Corp	Duke Energy Corp	Halliburton Co
Intel Corp	General Mills Inc	Exxon Mobil Corp	Freeport-McMoRan Inc	E I Du Pont De Nemours and Co	Hasbro Inc
Johnson & Johnson	HP Inc	Freeport-McMoRan Inc	Gap Inc	Exxon Mobil Corp	Home Depot Inc
Linde PLC	Intel Corp	Gap Inc	General Electric Co	Freeport-McMoRan Inc	Humana Inc
Marathon Oil Corp	International Business Machines Corp	General Electric Co	General Mills Inc	Gap Inc	Intel Corp
Marriott International Inc	Johnson & Johnson	General Mills Inc	Hasbro Inc	General Electric Co	Johnson & Johnson
Masco Corp	Johnson Controls International PLC	Halliburton Co	Healthpeak Properties Inc	Howmet Aerospace Inc	Johnson Controls International PLC
Mattel Inc	Kimberly-Clark Corp	HP Inc	Intel Corp	Intel Corp	JPMorgan Chase & Co
Merck & Co Inc	Marathon Oil Corp	Intel Corp	International Flavors & Fragrances Inc	International Business Machines Corp	Kohls Corp
Microsoft Corp	Masco Corp	Johnson & Johnson	Johnson & Johnson	Johnson & Johnson	Lockheed Martin Corp
Mondelez International Inc	Mattel Inc	Johnson Controls International PLC	Johnson Controls International PLC	Johnson Controls International PLC	Lowe`s Companies Inc
Newmont Corporation	Merck & Co Inc	Kimberly-Clark Corp	Mcdonald's Corp	Kohls Corp	Mcdonald's Corp
PepsiCo Inc	Microsoft Corp	Mcdonald's Corp	Merck & Co Inc	Lockheed Martin Corp	Microsoft Corp
PG&E Corp	Mondelez International Inc	Microsoft Corp	Microsoft Corp	Medtronic PLC	Mondelez International Inc
Pinnacle West Capital Corp	Motorola Solutions Inc	Mondelez International Inc	Mondelez International Inc	Merck & Co Inc	Mosaic Co
Prudential Financial Inc	Newmont Corporation	Newmont Corporation	Newmont Corporation	Microsoft Corp	Newmont Corporation
Public Service Enterprise Group Inc	NortonLifeLock Inc	NortonLifeLock Inc	NVIDIA Corp	Mondelez International Inc	NRG Energy Inc
Starbucks Corp	PepsiCo Inc	PepsiCo Inc	PG&E Corp	Newmont Corporation	PepsiCo Inc
State Street Corp	PG&E Corp	PG&E Corp	Qualcomm Inc	NVIDIA Corp	PG&E Corp
Tenet Healthcare Corp	Pinnacle West Capital Corp	Qualcomm Inc	Staples Inc	PepsiCo Inc	Qualcomm Inc
Texas Instruments Inc	Procter & Gamble Co	Staples Inc	Starbucks Corp	PG&E Corp	Staples Inc
United Parcel Service Inc	Public Service Enterprise Group Inc	Starbucks Corp	State Street Corp	Staples Inc	Starbucks Corp
Walmart Inc	Starbucks Corp	State Street Corp	Target Corp	Starbucks Corp	State Street Corp
Waste Management Inc	Tenet Healthcare Corp	Target Corp	Tenet Healthcare Corp	State Street Corp	Target Corp
Wells Fargo & Co	Texas Instruments Inc	Texas Instruments Inc	Texas Instruments Inc	Target Corp	Texas Instruments Inc
Whirlpool Corp	Time Warner Inc	Trane Technologies PLC	Walmart Inc	Texas Instruments Inc	Walmart Inc
Xerox Holdings Corp	Trane Technologies PLC	Waste Management Inc	Waste Management Inc	Walmart Inc	Waste Management Inc

2016	2017	2018	2019
Airgas Inc	Advance Auto Parts Inc	Advance Auto Parts Inc	ABIOMED Inc
Alexion Pharmaceuticals Inc	Alexion Pharmaceuticals Inc	Align Technology Inc	Align Technology Inc
AMETEK Inc	AMETEK Inc	AMETEK Inc	Brighthouse Financial Inc
Berkshire Hathaway Inc	Berkshire Hathaway Inc	Berkshire Hathaway Inc	Broadridge Financial Solutions Inc
Booking Holdings Inc	Booking Holdings Inc	Booking Holdings Inc	C.H. Robinson Worldwide Inc
C R Bard Inc	Broadcom Inc	Brighthouse Financial Inc	Cabot Oil & Gas Corp
C.H. Robinson Worldwide Inc	C R Bard Inc	Broadcom Inc	Centene Corp
Cablevision Systems Corp	C.H. Robinson Worldwide Inc	C R Bard Inc	Cerner Corp
Cabot Oil & Gas Corp	Cabot Oil & Gas Corp	C.H. Robinson Worldwide Inc	Charter Communications Inc
Cerner Corp	Cerner Corp	Cabot Oil & Gas Corp	Cimarex Energy Co
Cimarex Energy Co	Charter Communications Inc	Cerner Corp	Concho Resources Inc
Crown Castle International Corp	Cimarex Energy Co	Charter Communications Inc	Constellation Brands Inc
DENTSPLY SIRONA Inc	Concho Resources Inc	Cimarex Energy Co	Crown Castle International Corp
Diamond Offshore Drilling Inc	Constellation Brands Inc	Concho Resources Inc	D.R. Horton Inc
Endo International PLC	Coty Inc	Crown Castle International Corp	Diamondback Energy Inc
Equifax Inc	Crown Castle International Corp	D.R. Horton Inc	DISH Network Corp
Expedia Group Inc	CSRA Inc	DENTSPLY SIRONA Inc	Equifax Inc
Express Scripts Holding Co	DENTSPLY SIRONA Inc	DISH Network Corp	Expedia Group Inc
Fidelity National Information Services Inc	Discovery Inc	Duke Realty Corp	Extra Space Storage Inc
Fiserv Inc	Equifax Inc	Equifax Inc	Fiserv Inc
FLIR Systems Inc	Expedia Group Inc	Expedia Group Inc	Fleetcor Technologies Inc
FMC Technologies Inc	Express Scripts Holding Co	Extra Space Storage Inc	Fortive Corp
Fossil Group Inc	Extra Space Storage Inc	Fastenal Co	Genuine Parts Co
Genuine Parts Co	Fidelity National Information Services Inc	Fiserv Inc	Global Payments Inc
H & R Block Inc	Fiserv Inc	FLIR Systems Inc	H & R Block Inc
Harman International Industries Inc	FMC Technologies Inc	Fortive Corp	Helmerich and Payne Inc
Helmerich and Payne Inc	Fortive Corp	Genuine Parts Co	Huntington Ingalls Industries Inc
Illumina Inc	Genuine Parts Co	Global Payments Inc	IPG Photonics Corp
Jefferies Financial Group Inc	Global Payments Inc	H & R Block Inc	Jack Henry & Associates Inc
L3 Technologies Inc	H & R Block Inc	Helmerich and Payne Inc	Jacobs Engineering Group Inc
Lennar Corp	Helmerich and Payne Inc	Jefferies Financial Group Inc	Jefferies Financial Group Inc
Linear Technology Corp	Illumina Inc	L3 Technologies Inc	L3 Technologies Inc
Loews Corp	Jefferies Financial Group Inc	Lennar Corp	Lennar Corp
Monster Beverage Corp	Kraft Heinz Co	LKQ Corp	LKQ Corp
Netflix Inc	L3 Technologies Inc	Loews Corp	Loews Corp
Nielsen Holdings PLC	Lennar Corp	Monster Beverage Corp	Monster Beverage Corp
O'Reilly Automotive Inc	Linear Technology Corp	Netflix Inc	Nektar Therapeutics
Paychex Inc	LKQ Corp	Norwegian Cruise Line Holdings Ltd	Netflix Inc
Pioneer Natural Resources Co	Mid-America Apartment Communities Inc	Patterson Companies Inc	Norwegian Cruise Line Holdings Ltd
Precision Castparts Corp	Monster Beverage Corp	Paychex Inc	Paychex Inc
Quanta Services Inc	Navient Corp	Qorvo Inc	Qorvo Inc
Roper Technologies Inc	Netflix Inc	Quanta Services Inc	Rollins Inc
Sandisk LLC	Paychex Inc	Roper Technologies Inc	Roper Technologies Inc
Scripps Networks Interactive Inc	Quanta Services Inc	SBA Communications Corp	SBA Communications Corp
Stanley Black & Decker Inc	Roper Technologies Inc	Scripps Networks Interactive Inc	SCANA Corp
TripAdvisor Inc	Stanley Black & Decker Inc	Sealed Air Corp	Take-Two Interactive Software Inc
Under Armour Inc	TransDigm Group Inc	TransDigm Group Inc	TransDigm Group Inc
Vertex Pharmaceuticals Inc	TripAdvisor Inc	TripAdvisor Inc	TripAdvisor Inc
Westrock Co	Under Armour Inc	Under Armour Inc	Twitter Inc
Wynn Resorts Ltd	Universal Health Services Inc	Zions Bancorporation NA	Zions Bancorporation NA

F - List of Firms in Virtue Portfolio

2010	2011	2012	2013	2014	2015
3M Co	3M Co	3M Co	3M Co	3M Co	3M Co
Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Agilent Technologies Inc
Allstate Corp	Agilent Technologies Inc	Agilent Technologies Inc	Agilent Technologies Inc	Agilent Technologies Inc	Air Products and Chemicals Inc
American Electric Power Company Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Air Products and Chemicals Inc	Allstate Corp
Baxter International Inc	Allstate Corp	Allstate Corp	Altria Group Inc	Allstate Corp	Altria Group Inc
Becton Dickinson and Co	Altria Group Inc	Altria Group Inc	Analog Devices Inc	Altria Group Inc	Autodesk Inc
Campbell Soup Co	Analog Devices Inc	Avery Dennison Corp	Autodesk Inc	Analog Devices Inc	Baker Hughes Co
Cisco Systems Inc	Avery Dennison Corp	Baker Hughes Co	Baker Hughes Co	Autodesk Inc	Becton Dickinson and Co
Cleveland-Cliffs Inc	Baxter International Inc	Baxter International Inc	Baxter International Inc	Baker Hughes Co	Best Buy Co Inc
Coca-Cola Co	Campbell Soup Co	Becton Dickinson and Co	Campbell Soup Co	Baxter International Inc	Campbell Soup Co
Coca-Cola European Partners PLC	CBRE Group Inc	Campbell Soup Co	Caterpillar Inc	CA Inc	CBRE Group Inc
Colgate-Palmolive Co	Cisco Systems Inc	CBRE Group Inc	CBRE Group Inc	Campbell Soup Co	Cisco Systems Inc
Conagra Brands Inc	Citigroup Inc	Chevron Corp	Chevron Corp	Caterpillar Inc	Colgate-Palmolive Co
ConocoPhillips	Cleveland-Cliffs Inc	Cisco Systems Inc	Cisco Systems Inc	CBRE Group Inc	ConocoPhillips
Consolidated Edison Inc	Coca-Cola Co	Cleveland-Cliffs Inc	Cleveland-Cliffs Inc	Cisco Systems Inc	Cummins Inc
CVS Health Corp	Colgate-Palmolive Co	Colgate-Palmolive Co	Colgate-Palmolive Co	Citigroup Inc	CVS Health Corp
Dow Chemical Co	ConocoPhillips	Conagra Brands Inc	Conagra Brands Inc	Coca-Cola Co	Dow Chemical Co
E I Du Pont De Nemours and Co	CVS Health Corp	ConocoPhillips	ConocoPhillips	Colgate-Palmolive Co	Duke Energy Corp
Exxon Mobil Corp	Dow Chemical Co	CVS Health Corp	Cummins Inc	Conagra Brands Inc	E I Du Pont De Nemours and Co
Freeport-McMoRan Inc	E I Du Pont De Nemours and Co	Dell Inc	CVS Health Corp	ConocoPhillips	FedEx Corp
Gap Inc	Exxon Mobil Corp	Dow Chemical Co	Dell Inc	Cummins Inc	Freeport-McMoRan Inc
General Electric Co	Freeport-McMoRan Inc	Duke Energy Corp	Dow Chemical Co	CVS Health Corp	Gap Inc
General Mills Inc	Gap Inc	E I Du Pont De Nemours and Co	E I Du Pont De Nemours and Co	Dow Chemical Co	General Electric Co
Hershey Co	General Electric Co	Entergy Corp	Exxon Mobil Corp	Duke Energy Corp	Halliburton Co
Intel Corp	General Mills Inc	Exxon Mobil Corp	Freeport-McMoRan Inc	E I Du Pont De Nemours and Co	Hasbro Inc
Johnson & Johnson	HP Inc	Freeport-McMoRan Inc	Gap Inc	Exxon Mobil Corp	Home Depot Inc
Linde PLC	Intel Corp	Gap Inc	General Electric Co	Freeport-McMoRan Inc	Humana Inc
Marathon Oil Corp	International Business Machines Corp	General Electric Co	General Mills Inc	Gap Inc	Intel Corp
Marriott International Inc	Johnson & Johnson	General Mills Inc	Hasbro Inc	General Electric Co	Johnson & Johnson
Masco Corp	Johnson Controls International PLC	Halliburton Co	Healthpeak Properties Inc	Howmet Aerospace Inc	Johnson Controls International PLC
Mattel Inc	Kimberly-Clark Corp	HP Inc	Intel Corp	Intel Corp	JPMorgan Chase & Co
Merck & Co Inc	Marathon Oil Corp	Intel Corp	International Flavors & Fragrances Inc	International Business Machines Corp	Kohls Corp
Microsoft Corp	Masco Corp	Johnson & Johnson	Johnson & Johnson	Johnson & Johnson	Lockheed Martin Corp
Mondelez International Inc	Mattel Inc	Johnson Controls International PLC	Johnson Controls International PLC	Johnson Controls International PLC	Lowe`s Companies Inc
Newmont Corporation	Merck & Co Inc	Kimberly-Clark Corp	Mcdonald's Corp	Kohls Corp	Mcdonald's Corp
PepsiCo Inc	Microsoft Corp	Mcdonald's Corp	Merck & Co Inc	Lockheed Martin Corp	Microsoft Corp
PG&E Corp	Mondelez International Inc	Microsoft Corp	Microsoft Corp	Medtronic PLC	Mondelez International Inc
Pinnacle West Capital Corp	Motorola Solutions Inc	Mondelez International Inc	Mondelez International Inc	Merck & Co Inc	Mosaic Co
Prudential Financial Inc	Newmont Corporation	Newmont Corporation	Newmont Corporation	Microsoft Corp	Newmont Corporation
Public Service Enterprise Group Inc	NortonLifeLock Inc	NortonLifeLock Inc	NVIDIA Corp	Mondelez International Inc	NRG Energy Inc
Starbucks Corp	PepsiCo Inc	PepsiCo Inc	PG&E Corp	Newmont Corporation	PepsiCo Inc
State Street Corp	PG&E Corp	PG&E Corp	Qualcomm Inc	NVIDIA Corp	PG&E Corp
Tenet Healthcare Corp	Pinnacle West Capital Corp	Qualcomm Inc	Staples Inc	PepsiCo Inc	Qualcomm Inc
Texas Instruments Inc	Procter & Gamble Co	Staples Inc	Starbucks Corp	PG&E Corp	Staples Inc
United Parcel Service Inc	Public Service Enterprise Group Inc	Starbucks Corp	State Street Corp	Staples Inc	Starbucks Corp
Walmart Inc	Starbucks Corp	State Street Corp	Target Corp	Starbucks Corp	State Street Corp
Waste Management Inc	Tenet Healthcare Corp	Target Corp	Tenet Healthcare Corp	State Street Corp	Target Corp
Wells Fargo & Co	Texas Instruments Inc	Texas Instruments Inc	Texas Instruments Inc	Target Corp	Texas Instruments Inc
Whirlpool Corp	Time Warner Inc	Trane Technologies PLC	Walmart Inc	Texas Instruments Inc	Walmart Inc
Xerox Holdings Corp	Trane Technologies PLC	Waste Management Inc	Waste Management Inc	Walmart Inc	Waste Management Inc

2016	2017	2018	2019
3M Co	3M Co	3M Co	3M Co
Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Agilent Technologies Inc
Accenture PLC	Accenture PLC	Abbvie Inc	Air Products and Chemicals Inc
Adobe Inc	Agilent Technologies Inc	Agilent Technologies Inc	Altria Group Inc
Agilent Technologies Inc	Altria Group Inc	Air Products and Chemicals Inc	Amazon.com Inc
Air Products and Chemicals Inc	Autodesk Inc	Allstate Corp	Anthem Inc
Altria Group Inc	Bank of New York Mellon Corp	Altria Group Inc	Autodesk Inc
Autodesk Inc	Becton Dickinson and Co	Autodesk Inc	Baker Hughes Co
Avalonbay Communities Inc	Best Buy Co Inc	Becton Dickinson and Co	Best Buy Co Inc
Baker Hughes Co	Campbell Soup Co	Best Buy Co Inc	Boston Scientific Corp
Becton Dickinson and Co	Carnival Corp	Boeing Co	Campbell Soup Co
Best Buy Co Inc	CBRE Group Inc	Campbell Soup Co	Carnival Corp
Campbell Soup Co	Cisco Systems Inc	CBRE Group Inc	CBRE Group Inc
CBRE Group Inc	Citigroup Inc	Chevron Corp	Chevron Corp
Chevron Corp	Colgate-Palmolive Co	Cisco Systems Inc	Cisco Systems Inc
Cisco Systems Inc	Dominion Energy Inc	Citigroup Inc	Citigroup Inc
Citigroup Inc	FedEx Corp	Colgate-Palmolive Co	Colgate-Palmolive Co
Colgate-Palmolive Co	Freeport-McMoRan Inc	CVS Health Corp	Dominion Energy Inc
ConocoPhillips	Gap Inc	Dominion Energy Inc	DXC Technology Co
CVS Health Corp	General Electric Co	Freeport-McMoRan Inc	Ford Motor Co
Dominion Energy Inc	General Motors Co	Gap Inc	Freeport-McMoRan Inc
Dow Chemical Co	Gilead Sciences Inc	General Electric Co	Gap Inc
E I Du Pont De Nemours and Co	Hasbro Inc	General Motors Co	General Motors Co
Exxon Mobil Corp	Home Depot Inc	Gilead Sciences Inc	Goldman Sachs Group Inc
Gap Inc	Host Hotels & Resorts Inc	Halliburton Co	Halliburton Co
General Electric Co	Humana Inc	Hasbro Inc	Hasbro Inc
Gilead Sciences Inc	Intel Corp	Home Depot Inc	Host Hotels & Resorts Inc
Hasbro Inc	Johnson & Johnson	Humana Inc	HP Inc
Healthpeak Properties Inc	Johnson Controls International PLC	Intel Corp	Humana Inc
Howmet Aerospace Inc	JPMorgan Chase & Co	International Flavors & Fragrances Inc	Intel Corp
Humana Inc	Lockheed Martin Corp	Johnson & Johnson	International Flavors & Fragrances Inc
Intel Corp	Marriott International Inc	Kroger Co	Johnson & Johnson
International Business Machines Corp	Merck & Co Inc	Lockheed Martin Corp	JPMorgan Chase & Co
International Flavors & Fragrances Inc	Microsoft Corp	Lowe`s Companies Inc	Linde PLC
Johnson & Johnson	Motorola Solutions Inc	Macerich Co	Lowe`s Companies Inc
Johnson Controls International PLC	Northrop Grumman Corp	Merck & Co Inc	Microsoft Corp
JPMorgan Chase & Co	NRG Energy Inc	Microsoft Corp	Newmont Corporation
Lockheed Martin Corp	PepsiCo Inc	Northrop Grumman Corp	PepsiCo Inc
Lowe`s Companies Inc	PG&E Corp	PepsiCo Inc	PG&E Corp
Microsoft Corp	Philip Morris International Inc	PG&E Corp	Philip Morris International Inc
Motorola Solutions Inc	PNC Financial Services Group Inc	Philip Morris International Inc	Prologis Inc
PG&E Corp	Prologis Inc	Prologis Inc	S&P Global Inc
PVH Corp	Staples Inc	S&P Global Inc	State Street Corp
State Street Corp	State Street Corp	Sempra Energy	Target Corp
Target Corp	Target Corp	State Street Corp	Texas Instruments Inc
Texas Instruments Inc	Texas Instruments Inc	Target Corp	Ventas Inc
Walmart Inc	UnitedHealth Group Inc	Texas Instruments Inc	Walmart Inc
Waste Management Inc	Waste Management Inc	Waste Management Inc	Waste Management Inc
Wells Fargo & Co	Wells Fargo & Co	Wells Fargo & Co	Wells Fargo & Co
Weyerhaeuser Co	Weyerhaeuser Co	Weyerhaeuser Co	Yum! Brands Inc