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Does the sinner beat the saint? An empirical study of the Nordic stock market

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Abstract

This research paper studies the interaction between monthly returns of sin stock portfolios, where the purpose is to get an understanding of what impact an exclusion of sin stocks can have on portfolio returns for Nordic stock investors. OLS (ordinary least squares) time-series regression models are used to execute this research, using data between 1990-2018. The latter part of the paper presents the executed OLS time-series regressions, comparing four different dependent variables. Two sin stock portfolios against a comparable sin stock portfolio and two sin stock portfolios against all other stocks in the sample. Additionally classic factors such as market, size, value, momentum and beta are included as control variables in the models.

The OLS regression analyses indicate mixed results, since two of the dependent variables, SMC (Sin Minus Comparable) and SOMO (Sin Oil Minus Other), have alphas that are not significantly different from zero. Thereby it is hard to determine whether a sin stock anomaly is present or not. However, the dependent variables, SOMC (Sin Oil Minus Comparable) and SMO (Sin Minus Other) indicate that sin stock returns are significantly different from zero by 0.56% and 0.44% per month, respectively. This, on the other hand, supports the presence of a sin stock anomaly.

Keywords: *Sin Stocks, Sin Stock Anomaly, Nordic Stock Market, Fama-French Three-Factor Model, CAPM, Asset Pricing Models, Portfolio Asset Management, OLS, Gambling, Tobacco, Alcohol, Weapons, Oil & Gas, Self-Financing Portfolio Strategy*

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Contents

1 Introduction

This section provides a background of why sin stocks is an interesting topic for both me and the public.

1.1 Background

Stock portfolios which consists of companies producing tobacco, alcohol and gambling are usually defined as sin stock portfolios (Hong and Kacperczyk 2009; Blitz and Fabozzi 2017; Salaber 2007; Liston 2016; Statman and Glushkov 2009; Lobe and Walkshäusl 2016). These stock portfolios are of increased interest for the public, since more and more investors and investment managers ignore them while integrating social screening with their investment decisions (Connaker and Madsbjerg 2019). Socially responsible investment (SRI) combines investors' financial objectives with their concerns about social, ethical and environmental issues. SRI and avoiding investment in sin stocks are not always aligned, but sin stocks are the most often "negatively screened" stocks by socially responsible investors (Connaker and Madsbjerg 2019). Finally, an investor who aims to create an optimal portfolio from risky assets, limiting oneself to funds that include social norms in their investment policies can be very costly (Geczy, Stambaugh and Levin 2003). The Social Investment Forum approximates that about USD 2.34 trillion in 2001, or roughly 12% of the total assets under management (AUM), in that year undergo some kind of social screens (Geczy, Stambaugh and Levin 2003). This suggests a potential sizeable effect of socially responsible investing on sin stock prices. Moreover, updated figures suggests that the number is around USD 3 trillion in 2019.

Previous research papers have studied the historical financial performance of sin stocks and noticed that they have provided significantly positive abnormal stock returns (Berman 2002; Hong and Kacperczyk 2009; Blitz and Fabozzi 2017; Salaber 2007; Liston 2016; Statman and Glushkov 2009). Although, several investors are constrained and thereby obliged to exclude to invest in sin stocks, because they do not wish to be related with the business of these firms (Blitz and Fabozzi 2017). These investors include institutions with diverse constituents, institutions whose stock portfolios are public information and institutions that can be easily exposed to public investigations. According to Hong and Kacperczyk (2009), this group of investors include insurance companies, universities, religious organizations, pension funds and banks. They further imply, that analysts should cover sin stocks less, since they tend to comply to institutional investors. In opposition to institutional investors, individual investors can keep their stock portfolios out of the view of public information (i.e. authoritarians of societal norms). Therefore, Hong and Kacperczyk (2009) expect individual investors to be more likely, than institutional investors, to invest in sin stocks. Moreover, hedge funds and mutual funds represent another type of investors whom is expected to be more likely to include sin stocks in their portfolios, since they are essential arbitrageurs in the stock market. Hedge funds and mutual funds might be increasingly subject to social norm pressures (from the public) as observed by the recent growth of the SRI investors, some of them are expected to rebel against social agreements and include sin stocks in their portfolios, if they are excluded by other investors and priced at a discount. Despite this, there are no active exchange traded funds available investing in a well diversified sin stock portfolio. It is only possible to invest in exchange traded funds which focuses on particular subset categories within all publicly traded sin stocks (Blitz and Fabozzi 2017). Furthermore, Hong and Kacperczyk (2009) found less institutional ownership in sin stocks compared to other comparable stocks (with the same characteristics), during 1980–2006.

A common explanation for the declared abnormal returns of sin stocks, is that they are systematically undervalued and underpriced. This is because a majority of investors exclude them in their portfolios and due to lower analysts coverage. Their expected return is also higher since they are underpriced and thereby their expected dividend yield will be higher (Roll and Ross 1980). In addition, this enables investors, who are willing to invest in sin stocks, to go against current social norms and gain a reputation risk premium. This could be linked to the arbitrage pricing theory, by Roll and Ross (1980).

Several social scientists argue that social norms are important in shaping economic behaviour, even overriding the profit motives at times (Akerlof 1980). In Becker's (1957) model of discrimination in economics, agents (e.g. employers) discriminates a particular group of people by deciding to not interact with them, and this comes with financial costs. Previous empirical studies on the impact of social norms on markets has generally focused upon measuring the degree of discrimination in the labor force market (Altonji and Blank 1999; Levitt 2004). Related previous literature, reveal that social interactions (or peer effects) in general are important for several economic outcomes (Glaeser and Scheinkman 2003). Therefore, there can be significant financial costs from making constraints from social norms when investing, which makes the stock market suitable and interesting to study (Hong and Kacperczyk 2009). In addition, there is a diversification cost by limiting the stock sample and not invest in a certain group of publicly traded stocks, e.g. sin stocks. Further, sin stocks tend to trade relatively cheap when benchmarked against their comparables, i.e. low P/B (price to book) or P/E (price to earnings) ratios, according to Hong and Kacperczyk (2009). All the above papers, have been done on the US stock market or the global stock market, thus no research (or limited research) has been examined on the Nordic stock market. This is the main reason why this is so appealing.

A fundamental assumption of the capital asset pricing model (CAPM), is that all investors invest in the stock portfolio with the highest expected return per unit of risk (Sharpe ratio) (Merton 1973; Merton 1987), and leverage or de-leverage the portfolio to suit the investors' risk preferences (Fama-MacBeth 1973). Although, many agents, such as individuals, mutual funds, and pension funds, are constrained in the leverage they can take, and therefore overweight risky assets in their portfolios', instead of using leverage. For illustration purposes, many pension funds and mutual fund families offer balanced funds with a mix of stocks and bonds. The "normal" fund may invest approximately 60% in stocks and 40% in bonds, whereas the "aggressive" fund invests 90% in stocks and 10% in bonds. If the "normal" fund is efficient, then the investor could leverage it and achieve a better trade-off between risk and reward (expected return) than the "aggressive" portfolio with a large weight towards stocks (risky assets). This can cause a problem for institutional investors, due to their social and leverage constraints, which disables them from making certain investment decisions which could affect their expected risk-adjusted return negatively (Frazzini and Pedersen 2014).

Furthermore, these studies have primarily focused on the tobacco, alcohol, gambling and weapons industries when defining sin stocks. However, I will try to elaborate on previous research by including the oil & gas industry in the sin stock portfolio, for robustness purposes. I will also compare the sin stock portfolio with both a portfolio consisting of comparable stocks with similar characteristics as the sin stocks, as Fama-French (1993) and Hong & Kacperczyk (2009), and with a portfolio consisting of all other stocks in the data set. This will contribute to the research by using the longest time period and most up-to-date data on the Nordic market, from July 1990 to December 2018, which includes both the dotcom crash in the early 2000's and the financial crisis in 2007-2008. Furthermore, another incentive to investigate the Nordic stock market is because there is a limited amount of work within this field of sin stocks. In addition, I am based in the Nordics and have an interest in Nordic stocks, and therefore would like to contribute to the Nordic sin stock science field.

The practical relevance of this study is to impact investors' decision making, before investing in

Nordic stocks. I want to show the potential consequences of excluding sin stocks in investors' portfolios (i.e. lower portfolio returns). This is also a time when sustainable investments have become more popular in the Nordics (Social Investment Forum 2019), and they should be aware of this before making investment decisions.

In this paper, I provide new evidence on the Nordic market effects of social norms in the setting of the stock market, during 1990-2018. Specifically, I study the investing environment of sin stocks, i.e. publicly traded companies involved in the production of alcohol, tobacco, gambling, weapons and oil & gas. This is an ideal setting in which to study the effects of social norms on markets for several reasons. First, there is clearly a societal norm against funding operations that promote human vice, and consequently many investors may not want themselves or others to support these companies by investing in their stocks. Anecdotal evidence supporting this premise can be found in the embrace of socially responsible investing (SRI) by managers of institutions such as pension funds and endowments who screen their investments to rule out sinful stocks. Furthermore, the OLS regression analyses indicate mixed results, since two of the dependent variables, SMC and SOMO, have alphas that are not significantly different from zero. Thereby it is hard to determine whether a sin stock anomaly is present or not. However, the dependent variables, SOMC and SMO indicate that sin stock returns are significantly different from zero by 0.56% and 0.44% per month, respectively, which supports the presence of a sin stock anomaly in the Nordics. Furthermore, I want to investigate what impact an exclusion of sin stocks can have on portfolio returns for Nordic investors and conduct the following research question: Do sin stocks generate abnormal returns?

2 Literature Review

Trying to answer the research question stated in the introduction, several financial theories and previous empirical research are discussed in this section. In addition, four hypotheses are stated which are linked to the research question.

2.1 Theoretical Framework

An extension of microeconomic pricing theory, is the efficient market hypothesis (EMH). EMH fundamentally predicts that asset prices fully incorporate all available information in the market. It is impossible to constantly obtain abnormal returns (i.e. that exceed the return of the market), given a certain risk-level and a set of available information to investors. Fama (1970), one of the fathers in developing the EMH, separates between different levels of EMH tests based on accessible information. Strong form efficiency implies that stock prices reflect both public and private information (i.e. all information). Semi-strong form efficiency implies that stock prices only reflect all public information. Weak form efficiency means that the current stock price incorporates all historical data, which means that past asset prices cannot be used to predict current or future asset prices. Each type of efficiency includes the previous efficiency level, which means that if stock markets are efficient in the strong form, the fundamental assumptions of semi-strong and weak form efficiency also hold. Among these forms of efficiency, the semi-strong form is most often assumed and accepted, although in some situations it seems like if not even weak form efficiency holds. In the intervening period of time, strong form efficiency is not considered realistic, according to Fama (1970), as it denies the possibility that corporate insiders could use private information to gain abnormal returns on their investments at the expense of outsiders (i.e. non-insiders). In addition, a presence of a sin stock anomaly implies that some investors are irrational, i.e. exclude sin stocks (due to social norms) and this comes with financial costs. This violates all of the three forms of efficiency in the EMH, since the theory is based on rational and profit maximizing investors. However, if there is no sin stock anomaly present, at least the weak form efficiency is most likely to hold.

Another fundamental concept in financial theory is arbitrage pricing. Sharpe and Alexander (1990) defines it as "the simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices". Arbitrage plays an important role in the analysis of stock markets, because the arbitrage theory is to drive prices to fundamental values and keep markets efficient (Shliefer and Vishny 1997). There are some essential assumptions in the arbitrage theory, such as all investors are utility & profit maximizing and rational in their investment decisions. This means that their main objective is always to maximize profits, rather than maintain other motives, e.g. social norms. If this assumption holds, it is not possible to gain arbitrage, according to Roll and Ross (1980). Additionally, a presence of a sin stock anomaly implies that all investors are not rational and this could lead to arbitrage possibilities. This is in line with the arbitrage price theory (Shliefer and Vishny 1997).

Investors advocate at least some diversification when constructing an asset portfolio. The reason for this is that diversification can reduce the idiosyncratic risk (i.e. firm-specific risk). Sharpe (1972 and 1995) argues, that when an asset performs worse than expected, given the market's total performance, another is probably doing superior than expected. In general, the more assets in a portfolio, the probability increases that adequate good fortune will appear to balance off the bad fortune. In addition, there are other considerations than just the number of assets in a portfolio. Sharpe (1972 and 1995) argues that "a portfolio of ten chemical securities is likely to offer less effective diversification than one of ten securities, each from a different industry". This implies that there are diversification costs if one would ignore one or more industries when conducting an asset portfolio (Sharpe 1972; Sharpe 1995).

2.2 Previous Empirical Research

Hong and Kacperczyk (2009) researched if sin stocks outperformed other stocks during the time period 1965-2006 on both the US and global stock market. They classified sin stocks as Fama and French (1997) did in the following way: industry classification group 4 (beer or alcohol), group 5 (smoke or tobacco) and NAICS (North American Industry Classification System) codes 7132, 71312, 713210, 71329, 731290, 72112 and 721120 (gambling). They found evidence that sin stocks have positive alphas for the one-, three- and four-factor model of approximately 3% per annum. Moreover, they argued that this result was robust when they extended the data set back to 1926 as well.

Fabozzi, Ma and Oliphants' (2008) study used a global sample covering 21 national stock markets during the time period 1970-2007. Their sin stock portfolio consisted of stocks from the following six industries: (i) alcohol, (ii) tobacco, (iii) defense, (iv) biotech, (v) gambling and (vi) pornography. They concluded that sin stocks outperform the market by more than 3% annually in absolute returns and by approximately 6% annually on a beta-adjusted basis.

Additionally, Statman and Glushkov (2009) researched sin stocks during the time period 1992-2007 on the US stock market. They included stocks from the alcohol, tobacco, gambling, weapons and nuclear operations industries in their sin stock portfolio. They found positive alphas for the one-, three-, and four-factor model of approximately 2-3% per annum. Moreover, these findings are consistent with both Hong and Kacperczyk (2009) and Fabozzi, Ma and Oliphant (2008).

Salaber (2007) examined a report of sin stocks from 18 European stock markets. The paper's sin stock portfolio consisted of stocks from the tobacco, alcohol and gambling industries during the time period 1975-2006. He found that the return of sin stocks differs between the European countries and this is mainly depending on the religious and legal environments of the country where the sin stocks are publicly traded. Further, Salaber (2007) found that sin stocks outperforms other stocks when their litigation risk is higher, after adjusting for classic factors such as size and book-to-market ratios.

On the other hand, Lobe and Walkshäusl (2016) studied a global, regional and domestic sin stock portfolio and compared them with a corresponding socially responsible stock portfolio. On the contrary of the previous papers, they found no statistically significant evidence that sin stocks outperform nor underperform other stocks. However, they included the following industries in their sin stock portfolio: (1) alcohol, (2) tobacco, (3) gambling, (4) weapons, (5) pornography and (6) nuclear power. Additionally, the nuclear power industry dominates the sin stock portfolio with 46% of the sample. The returns in the nuclear power sector has not been anomalous, which could bias the results. Moreover, none of the seven previous studies on sin stocks, that Lobe and Walkshäusl (2016) refers to in their study, includes the nuclear power industry in the sin stock portfolio (Blitz and Fabozzi 2017).

Blitz and Fabozzi (2017) examined a research study on sin stocks (alcohol, tobacco, gambling and weapons industries) on the US, European, Japanese and global stock market. The data was taken from the time periods 1963-2016, 1973-2016 and 1990-2016 for the US stocks, and 1990-2016 for the European, Japanese and global stocks. They found that the one-, two- and three-factor model has both statistically and economically significant positive alphas after controlling for the classic size, value and momentum factors. These findings are in line with previous research. However, they also added two additional factors from the Fama and French (2015) five-factor model; the profitability factor RMW (robust minus weak) and the investment factor CMA (conservative minus aggressive) to their regression models. In addition, they also added the beta factor BAB (betting against beta) by Frazzini and Pedersen (2014), which strategy is to go long stocks with low beta values and short-sell stocks with high beta values. When including these factors in the model, Blitz and Fabozzi (2017) found that sin stocks tend to be low-betas. Furthermore, they found that the two new Fama-French factors and the BAB factor explain the sin stock anomaly.

Liston (2016) researched sin stocks using monthly data during January 1988 to June 2009 on the US stock market. He defined sin stocks in a similar way as Hong and Kacperczyk (2009) and includes (i) alcohol, (ii) tobacco and (iii) gambling industries in the sin stock portfolio. He found that sentiments-augmented asset pricing models implies that both institutional and individual investor sentiments are priced factors in sin stock returns. Furthermore, he also found evidence for volatility clustering and a leverage effect in the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model.

To summarize, previous research show that sin stocks have outperformed comparable stock portfolios and other market stock portfolios. There are only two papers, Lobe and Walkshäusl (2016) and Blitz and Fabozzi (2017), which do not receive these results. A reason for this might be that they add nuclear power industry to the sin stock portfolio and Fama and French (2015) five-factors, as control variables, to the model.

2.3 Hypotheses

As mentioned in earlier sections, the EMH is probable to be violated, since all investors do not always make rational investment decisions, e.g. exclusion of sin stocks which comes with financial costs (Fama 1970). In addition, the exclusion of sin stocks is also associated with a diversification cost (Sharpe 1972; Sharpe 1995). Moreover, since several investors (e.g. insurance companies, universities, religious organizations, pension funds and banks) sometimes exclude sin stocks (Hong and Kacperczyk 2009), there is an arbitrage possibility for other investors, e.g. hedge funds and mutual funds (Shliefer and Vishny 1997; Roll and Ross 1980; Sharpe and Alexander 1990). Additionally, previous empirical research show that sin stocks outperforms comparable stock portfolios and other market stock portfolios (Hong & Kacperczyk 2009; Fabozzi, Ma & Oliphant 2008; Statman & Glushkov 2009; Blitz & Fabozzi 2017). Based on the theoretical framework and previous empirical research on sin stock performance, I have developed four hypotheses, which states that sin stock portfolios outperform both comparable stock- and other stock portfolios. The reason why

I want to test four different hypotheses is to make robustness checks to minimize biases. The first hypothesis measures if the sin stock portfolio outperforms a comparable stock portfolio, similar to Hong and Kacperczyk (2009), with similar industry classification in both the sin stock and comparable stock portfolio as Fama and French (1997). This is the main dependent variable in this paper and this hypothesis test if the SMC factor has statistically significant positive return, i.e. if the sin stock portfolio outperform the comparable portfolio. It is stated in the following way:

H1: Sin stocks (Alcohol, Tobacco, Gambling and Weapons industries) will outperform comparable stocks (Food, Soda, Fun and Meals & Hotels industries).

The second hypothesis is a complement and a robustness check to the first hypothesis, since here the sin stock portfolio is compared to a portfolio consisting of all other stocks in the data set. This hypothesis test if the SMO factor has statistically significant positive return, i.e. if the sin stock portfolio outperform the other stock portfolio. It is stated in the following way:

H2: Sin stocks (Alcohol, Tobacco, Gambling and Weapons industries) will outperform other stocks (all other industries in the data sample).

Furthermore, the total sin stock portfolio consists of 41 companies from the alcohol, tobacco, gambling and weapon industries during 1990-2018. Further, during the year 1990 the sin stock portfolio only consists of 5 companies as Table 11 (Appendix) shows. To deal with this problem, I want to make robustness tests where I include the oil & gas industry in the sin stock portfolio as well. By doing this, I try to eliminate the problem with too few companies each year, as the number of companies in the sin stock portfolio increases from 5 up to 17 during 1990, which is the year with the fewest number of companies as Table 12 (Appendix) shows. This hypothesis test if the SOMC factor has statistically significant positive return, i.e. if the sin stock portfolio outperform the comparable portfolio. Therefore the third hypothesis is stated in the following way:

H3: Sin stocks (Alcohol, Tobacco, Gambling, Weapons and Oil & Gas industries) will outperform comparable stocks (Food, Soda, Fun and Meals & Hotels industries).

The fourth and last hypothesis is a complement and a robustness check to the third hypothesis, since here the sin stock portfolio is compared to a portfolio consisting of all other stocks in the data set. This hypothesis test if the SOMO factor has statistically significant positive return, i.e.

if the sin stock portfolio outperform the other stock portfolio. It is stated in the following way:

H4: Sin stocks (Alcohol, Tobacco, Gambling, Weapons and Oil & Gas industries) will outperform other stocks (all other industries in the data sample).

3 Methodology

This section starts to specify the regression models used in this paper. After that, the sin stock and comparable stock portfolios are defined. Further, the dependent variables and control variables are defined. At last, robustness tests are made to avoid biased results.

3.1 Model Specification

Several time-series regression models are specified with four different dependent variables, that are described in earlier sections. Each regression model is executed to test each of the four hypotheses stated in earlier sections. Furthermore, five control variables are also included in the regression models. The first (1) regression model is linked to hypothesis H1 and is illustrated in the following way:

$$SMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t \quad (1)$$

where t=1, ... 342, which is the monthly return for a long position in the sin stock portfolio (Sin Minus Comparable) in month t, net the return for a short position in the comparable stock portfolio in month t. The second (2) regression model is linked to hypothesis H2 and is specified in the following way:

$$SOMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t \quad (2)$$

which is the monthly return for a long position in the sin stock portfolio (Sin Oil Minus Comparable) in month t, net the return for a short position in the comparable stock portfolio in month t. The third (3) regression model is connected to hypothesis H3 and is specified in the following way:

$$SMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t \quad (3)$$

which is the monthly return for a long position in the sin stock portfolio (Sin Minus Others) in month t, net the return for a short position in the other stock portfolio in month t. The fourth (4) and last regression model testing hypothesis H4 and is specified in the following way:

$$SOMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t \quad (4)$$

which is the monthly return for a long position in the sin stock portfolio (Sin Oil Minus Others) in month t, net the return for a short position in the other stock portfolio in month t.

In previous research studies, e.g. Blitz & Fabozzi (2017), Fama-French five-factor model was used as control variables on the global, US, European and Japanese stock markets. It was retrieved from the Kenneth R. French database. Unfortunately, data on the Fama-French profitability factor RMW and the investment factor CMA is not available for the Nordic stock market. Due to this reason, these factors are excluded in the OLS regression models.

3.2 Defining Sin Stock Portfolio

Table 11 (Appendix) shows the distribution of the sin stock portfolio which includes stocks from the alcohol, tobacco and gambling industries. This definition of sin stocks is similar to Blitz and Fabozzi (2017), Hong and Kacperczyk (2009), Liston (2016), and Salaber (2007). They define their industry classifications similar as Fama and French (1997) with the following SIC (Standard Industrial Classification) and NAICS codes: industry group 4 (Beer or Alcohol) and industry group 5 (Smoke or Tobacco). Stocks with SIC codes 2100-2199 belong to the beer group and stocks with SIC codes 2080-2085 are in the smoke group. The Fama-French classification scheme does not separate gambling stocks from hotel and entertainment stocks. That is why they use the NAICS codes as well, where gambling stocks are identified with the following NAICS codes: 7132, 71312, 713210, 71329, 713290, 72112 and 721120. Since this data sample consists of stocks from the Nordic stock market, it is not possible to use the NAICS codes since they are only applicable on North American stocks. To get around this, the following GICS (Global Industry Classification Standard) codes are used: (i) 30201010 (Brewers) & 30201020 (Distillers & Vintners) for the alcohol portfolio, (ii) 30203010 (Tobacco) for the tobacco portfolio and (iii) 25301010 (Casinos & Gambling) for the gambling portfolio. Furthermore, the weapons industry are also included in the sin stock portfolio, in accordance to Blitz & Fabozzi (2009), Lobe & Walkshäusl (2016), Statman & Glushkov (2009) and Fabozzi, Ma & Oliphant (2008). The GICS code 20101010 (Aerospace & Defense) is used for the weapons industry. Furthermore, there are 11, 2, 15 and 13 companies in the alcohol, tobacco, gambling and weapons industry, respectively, as Table 11 (Appendix) shows. In addition, Table 1 shows that the sin portfolio consists of 26 Swedish, 6 Norwegian, 7 Danish and 2 Finnish companies.

Furthermore, the total sin stock portfolio consists of 41 companies from the alcohol, tobacco, gambling and weapons industries during 1990-2018, which equals 2.1% of the total data set. Further, during the year 1990 the sin stock portfolio only consists of 5 observations as Table 11 (Appendix) shows. To handle this problem robustness checks are made, where the oil & gas industry is included in the sin stock portfolio as well. For this industry, the following GICS codes are used: 10101010 (Oil & Gas Drilling), 10101020 (Oil & Gas Equipment & Services), 10102010 (Integrated Oil & Gas), 10102020 (Oil & Gas Exploration & Production), 10102030 (Oil & Gas Refining & Marketing), 10102040 (Oil & Gas Storage & Transportation) and 10102050 (Coal & Consumable Fuels) for the oil & gas industry. When including these stocks, the sin stock portfolio consists of 153 companies (Table 2) which equals 7.8% of the total sample size. The oil & gas industry comprises of 112 of these companies (Table 2), which equals 5.7%. With this course of action, the number of observations in the sin stock portfolio increases from 5 up to 17 during 1990. This attempts to eliminate the issue of too few observations each year (Table 10, Appendix).

Another typical sin industry is pornography, which is not included in my sin stock portfolio, because of an index for this sector is simply not available. Due to the fact that it is a very small industry in the public equity markets, it will have little or no impact on the results. In addition, industries identified as sin stocks in a small minority of the studies, such as biotech or nuclear power, are neither included.

Moreover, the sin stock portfolio is defined as the alcohol, tobacco, gambling, weapons and oil & gas industries. One problem that can occur when conducting the sin stock portfolio is survivor bias. This means that only survivor stocks will be included in the sin stock portfolio, rather than stocks that has defaulted or been acquired and gone privately owned. To avoid this problem, all publicly traded stocks on the Nordic stock market during July 1990 to December 2018 are used, instead of only gather historically data on today's publicly traded stocks. Additionally, the sin stock portfolio is re-balanced every month. This means it will include all sin stocks available for each month during 1990-2018.

3.3 Defining Comparable Stock Portfolio

Hong and Kacperczyk (2009) used a dependent variable EXCOMP ($SINP_t - COMP_t$), which is the monthly return of an equal weighted sin stock portfolio in month t, net the monthly return of an equal weighted comparable stock portfolio in month t, similar to Fama and French (1997).

Table I: Distribution of the Sin Stock portfolio (excl. Oil & Gas industry). This table shows the sin stock portfolio distributed by industry and country

Country	All	Alcohol	Tobacco	Gambling	Weapons
Sweden	26	4	1	12	9
Norway	6	1	0	2	3
Denmark	7	4	1	1	1
Finland	2	2	0	0	0
Total	41	11	2	15	13

Table II: Distribution of the sin stock portfolio (incl. Oil & Gas industry). This table shows the sin stock portfolio distributed by industry and country

Country	All	Alcohol	Tobacco	Gambling	Weapons	Oil & Gas
Sweden	50	4	1	12	9	24
Norway	92	1	0	2	3	86
Denmark	7	4	1	1	1	0
Finland	4	2	0	0	0	2
Total	153	11	2	15	13	112

Further, Hong and Kacperczyk (2009) used the Fama and French (1997) industry groups 2 (Food), 3 (Soda), 7 (Fun) and 43 (Meals & Hotels) as the comparable stock portfolio. The following GICS codes are used for the comparable stock portfolio: (i) 30101020 (Food Distributors), 30101030 (Food Retail), 30202010 (Agricultural Products) 30202030 (Packaged Foods & Meats) & 30101040 (Hypermarkets & Super Centers) for the food portfolio, (ii) 30202010 (Soft Drinks) for the soda portfolio, (iii) 50202010 (Movies & Entertainment) for the fun portfolio and (iv) 25301020 (Hotels, Resorts & Cruise Lines), 25301040 (Restaurants) and 60101030 (Hotel & Resorts REITs) for the meals & hotels portfolio. Table 13 (Appendix) distributes the comparable stock portfolio during 1990-2018 and it consists of 15 stocks from the food industry, 1 stock from the soda industry, 5 stocks from the fun industry and 18 stocks from the meals & hotels industry, respectively. Additionally, Table 3 shows the distribution of comparable stocks by country; where it consists of 18 Swedish, 8 Norwegian, 6 Danish and 7 Finnish stocks, which concludes that the comparable stock portfolio consists of 39 stocks in total, which equals 2.0% in total.

Table III: Distribution of the comparable stock portfolio (incl. Food, Soda, Fun and Meals & Hotels industries). This table shows the comparable stock portfolio distributed by industry and country

Country	All	Food	Soda	Fun	Meals & Hotels
Sweden	18	5	1	3	9
Norway	8	3	0	0	5
Denmark	6	4	0	2	0
Finland	7	3	0	0	4
Total	39	15	1	5	18

3.4 Dependent Variables

Four dependent variables are conducted in the models, where five OLS regression models are executed for every dependent variable. The main dependent variable, SMC (Sin Minus Comparables), is the total return for the equal weighted sin stock portfolio which excludes the oil & gas industry. These monthly returns are compared with a comparable equal weighted portfolio which consists of stocks with the same characteristics as the sin stock portfolio, from the food, soda, fun and meals & hotels industries, similar to Fama and French (1997). Then the agent takes a long position in the sin stock portfolio in month t and short-sell the comparable stock portfolio in month t, which makes it a self-financing strategy, similar to Hong and Kacperczyk (2009). The second dependent variable, SOMC (Sin Oil Minus Comparables), is the total return for the equal weighted sin stock portfolio which includes the oil & gas industry. Then a self-financing portfolio is conducted, i.e. the agent invests in the sin stock portfolio in month t and short-sells the comparable portfolio in month t. The third dependent variable, SMO (Sin Minus Others), is the total return for the equal weighted sin stock portfolio which excludes the oil & gas industry. Then these monthly returns are compared with an equal weighted portfolio of all other stocks in the data set. Then a self-financing portfolio is conducted, i.e. invests in the sin stock portfolio in month t and short-sells the portfolio of all other stocks in month t. Finally, the fourth and last dependent variable, SOMO (Sin Oil Minus Others), is the total return for the equal weighted sin stock portfolio which includes the oil & gas industry. Then a self-financing portfolio is conducted, similar to the portfolios above.

3.5 Control Variables

The following five control variables are extracted from AQR Asset Management's data library: (i) market excess return factor (MKT), (ii) size factor (SMB), (iii) value factor (HML), (iv) momentum factor (WML) and (v) beta factor (BAB). The MKT factor is conducted by a market portfolio of all Nordic publicly listed companies, net the risk-free interest rate (monthly US Treasury Bill). This is similar to the market factor in the CAPM (Sharpe 1964; Lintner 1965; Mossin 1966). In addition, the SMB factor is conducted by taking a long position in companies with the smallest market capitalization and short-sell the companies with the biggest market capitalization. Further, the HML factor is conducted by taking a long position in value stocks and short-sell growth stocks. These two factors are similar to the size and value factors from the Fama-French three-factor model (Fama and French 1993). This methodology is also similar to Hong & Kacperczyk (2009) and Blitz & Fabozzi (2017). Furthermore, the momentum factor WML is conducted by taking a long position in the winning stocks which has the highest return LTM (last twelve months) and short-sell the losing stocks with the lowest return (or negative return) LTM. This is similar to Hong & Kacperczyk (2009) and Blitz & Fabozzi (2017). At last, the beta factor BAB (betting against beta) is conducted by taking a long position in low beta stocks and short-sell high beta stocks, similar to Blitz & Fabozzi (2017) and Frazzini & Pedersen (2014).

3.6 Robustness Tests

Several robustness tests are made in this research paper to avoid different kinds of biases. The oil & gas industry is included in the sin stock portfolio to reduce the potential problem of too few observations and thereby biased results. On the other hand, there is a trade-off between including the oil & gas industry in the sin stock portfolio, since the proportion of stocks from the oil & gas industry in the sin stock portfolio is very large. This means that the sin stock return is very dependent on how the oil & gas industry has performed over the last 30 years, and this could obviously bias the results. However, I have chosen to include the oil & gas industry in the sin stock portfolio for robustness purposes. In addition, the soda and food industries are comparable industries to the alcohol industry. The fun, and meals & hotels industries are comparable industries to the gambling and tobacco industries. Moreover, the weapons and oil & gas industries are included in the sin stock portfolios, but lack clear comparable stock industries. Due to this reason, all other non-sin stocks are shorted in the dependent variables SMO and SOMO, for robustness purposes. Additionally, the number of observations is very small in some years for some of the comparable industries. This increases the rationality of including the SMO and SOMO variables, as well.

3.6.1 Breusch-Pagan Test For Heteroskedasticity

To make robustness checks in the data set, Breusch-Pagan's test for heteroskedasticity is executed to determine whether the error term is normally distributed or not. When the Breusch-Pagan test is conducted, one finds that the null hypothesis that the error term is normally distributed (constant variance) has to be rejected even at the 1% significance level. This means that there is heteroskedasticity in the data set, which Table 4 shows. In order to correct for this problem, robust standard errors are used in all OLS regression models (Wooldridge, 2015).

Table IV: Breusch-Pagan Test for Heteroskedasticity

Breusch-Pagan Test	SMC	SOMC	SMO	SOMO
Chi2-value	94.26	7.41	15.52	105.09
P-value	0.00***	0.19	0.01***	0.00***
Degrees of freedom	5	5	5	5

Note: This table presents a Breusch-Pagan test for heteroskedasticity. Regressions that rejects the null hypothesis of a constant variance are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. Table 4 shows that heteroskedasticity is present and thereby robust standard errors are used in the regression models.

3.6.2 Breusch-Godfrey Test for Serial Correlation

The Breusch-Godfrey test is applied to test whether there is serial correlation or not in the data set. The test is conducted for past 12 month returns to see if there is any auto-correlation present in the data set. Table 5 shows that the p-value is very large for all OLS regressions, and thereby one fails to reject the null hypothesis that there is no serial correlation in the data set, even at the 10% level. In order to correct for the serial correlation, robust standard errors are still used in all OLS regression models (Wooldridge, 2015).

Table V: Breusch-Godfrey Test for Serial Correlation

Breusch-Godfrey Test	SMC	SOMC	SMO	SOMO
Chi2-value	0.00	0.00	0.00	0.00
P-value	1.00	1.00	1.00	1.00
Degrees of freedom	12	12	12	12

Note: This table presents a Breusch-Godfrey test for serial correlation. Regressions that rejects the null hypothesis of no serial correlation are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. Table 5 test for serial correlation for the last 12 months and one can conclude that there is no serial correlation present in the data set.

3.6.3 Correlation Matrix

To check for multicollinearity, a pair-wise correlation matrix is constructed. The pair-wise correlation matrix shows the correlation between the dependent and control variables. It can take values from negative 1 to positive 1, where negative 1 is perfect negative correlation and positive 1 is perfect positive correlation. The multicollinearity problem arises when the correlation between two variables exceeds the absolute value of 0.9. In terms of the pair-wise correlation matrix, the highest correlation measured between independent variables equals 0.35 which takes place between the beta and momentum factors. This is presented in Table 14 (Appendix). Therefore, one concludes that the data set does not suffer from problems with multicollinearity (Wooldridge, 2015).

4 Data

This section provides a summary of the data collection used in this thesis.

4.1 Data Collection

The data set consist of 2,089 publicly traded companies from the Swedish, Norwegian, Danish and Finnish stock market. An amount of 113 shares are excluded from the data set due to missing observations or lack of GICS codes, leaving us with 1,967 shares remaining which Table 6 shows. The total sample consists of 1,020 Swedish, 412 Norwegian, 305 Danish and 230 Finnish companies, which also is shown in Table 6. The data set consist of monthly data during July 1990 to December 2018, since this is the longest time period available for the Nordic market at WRDS (Wharton Research Data Services). The ISIN- (International Securities Identification Number) and GICS codes for the data set has been extracted from WRDS and, then Thomson Reuters Eikon Database has been used to extract all the stock returns to Microsoft Excel through DataStream. Further, the factors from the Fama-French three-factor model, the momentum and beta factors are used and it has been extracted from AQR Asset Management's (2019) data library.

Table VI: Distribution of sample size distributed by country. This table shows the final sample size that has been used throughout the thesis

Country	Sample Size
Sweden	1,020
Norway	412
Denmark	305
Finland	230
Total	1,967

5 Results and Analysis

This section provide tables of the time-series regression results for all four sin stock factors SMC, SOMC, SMO and SOMO, respectively. The SMC factor is the main dependent variable, since it is constructed similar to Hong & Kacperczyk (2009) and Blitz & Fabozzi (2017). It presents the results for all different alphas and other classic control variables such as, market excess return, size, value, momentum and beta. At last, analyses of the results are presented.

5.1 Sin Minus Comparables (SMC)

Figure 1 shows that the SMC factor has a cumulative return of approximately 150% in total during 1990-2018, using 342 monthly observations. Almost all of this monthly cumulative return is gained during the years 2003-2006, which is the time just before the financial crisis took place. Moreover, the sin stock portfolio (excl. Oil & Gas industry) net the risk-free rate has a cumulative return of approximately 410% in total during 1990-2018 (Figure 2). One can see that Figure 1 is much more volatile compared to Figure 2, which looks more like a straight line with an upward slope.

Table 7, 8, 9 and 10 contains results for the sin stock factors SMC, SMO, SOMC and SOMO, respectively. All results are based on monthly returns from the Nordic stock market from the WRDS database for the time period July 1990 to December 2018. The first regression in Table 7 shows that sin stocks have a one-factor alpha of 0.22% per month, which is economically, but not statistically significant even at the 10% level. Moreover, the alphas for regression 2-5 ranging between 0.22-0.42% per month, when controlling for classic factors, size, value, momentum and beta. These results are also economically significant, but not statistically significant even at the 10% level. Furthermore, in all five regressions in Table 7, the exposure to the market factor is strongly and significantly positive even at the 1% significance level. Further, the size & value factors and the momentum & beta factors are economically significant with positive and negative signs, respectively. However, none of these four factors are statistically significant even at the 10% level. In addition, the adjusted R^2 ranging between 14% to 27% in the one- and five-factor model, respectively.

Since there are no statistical significant results, which does not emphasize a sin stock anomaly, one can argue that at least the weak form efficiency of the EMH holds. This implies that one fails to conclude that investors are irrational. Further, the results tend to violate the arbitrage theory, since there are no excess returns gained from the sin stock portfolio. This could imply that investors that tend to exclude sin stocks (e.g. insurance companies, universities, religious organizations, pension funds and banks) in other geographical markets, according to Hong and Kacperczyk (2009), is not ignoring them on the Nordic market (at least not to the same extent). One could also argue, that the theory of diversification costs is violated. The reason for this could be that the sin stock sample is too small (around 2-3% of the total sample) to impact the diversification costs for the investors. Additionally, the results are not aligned with previous empirical research, which show that sin stocks outperforms comparable stock portfolios and other market stock portfolios (Hong and Kacperczyk 2009; Fabozzi, Ma and Oliphant 2008; Statman and Glushkov 2009; Blitz and Fabozzi 2017). A reason for this could be due to differences in ownership between geographical markets, i.e. different ownership in the US, Europe, global market and Japan vs. in the Nordics. Another potential reason for the inequalities could be that the definition of sin stocks differs, along with the approach used when measuring sin stocks against non-sin stocks. One potential reason that could bias the results are too few observations used when constructing stock portfolios, i.e. too few observations in both the sin- and comparable stock portfolios. Another reason could be due to omitted variable bias, e.g. the investment and profitability factors from the Fama-French five-factor model are not included in the regression models, due to lack of data. Furthermore, a potential explanation for the differences could be due to inclusion of the BAB factor as a control variable in the regression models, which were included by Blitz & Fabozzi (2017) and Frazzini & Pedersen (2014), but excluded by Hong & Kacperczyk (2009), Lobe & Walkshäusl (2016), Salaber (2007), Statman & Glushkov (2009) and Fabozzi, Ma & Oliphant (2008). In addition, the results implies that sin stocks tend to be high-beta stocks. This is also contradictory to previous research done by Hong & Kacperczyk (2009), Fabozzi, Ma & Oliphant (2008), Statman & Glushkov (2009), Liston (2016) and Blitz & Fabozzi (2017), which found evidence for a low-beta anomaly among sin stocks. At last, the adjusted R^2 values are significantly lower than in previous research studies (Statman and Glushkov 2009; Liston 2016; Blitz and Fabozzi 2017). This means that the variation in the dependent variables cannot fully be explained by the regression models, i.e. omitted variable bias could affect the results.

5.2 Sin Minus Others (SMO)

Figure 3 (Appendix) shows that the SMO factor has a cumulative return of approximately 120% in total during 1990-2018. The graph has a peak at around 80% in the early 90's, followed by a drop to negative territories and then it almost moves sideways until 2006. During and after the financial crisis, there is a steady upward sloping trend in the graph, with a total cumulative return of 120% in total during 1990-2018.

In Table 8, the analysis is repeated using the SMO as the dependent variable. The first regression presents that sin stocks have a one-factor alpha of 0.44% per month, which is both economically and statistically significant at the 5% significance level. Additionally, Fama-French two- and three-factor alphas equals 0.44% and 0.42%, respectively, and are both economically and statistically significant at the 5% significance level. Further, the four- and five-factor alphas equals 0.20% and 0.22% and are economically, but not statistically significant even at the 10% significance level. In both regressions 1-4 and 5 in Table 8, the exposure to the market factor is economically and significantly negative at the 1% and 5% significance levels, respectively. Additionally, the momentum factor is also economically and statistically significant with a positive sign even at the 1% level. However, the size, value and beta factors are neither economically nor statistically significant even at the 10% significance level. The adjusted R^2 ranging between 9% to 17% in the one- and five-factor model, respectively.

Due to the statistical significant results, which does emphasize a sin stock anomaly, one can argue that not even the weak form efficiency of the EMH holds. This suggests that at least some investors are irrational. Further, the results tend to support the arbitrage theory, since there are abnormal returns gained from the sin stock portfolio. One could also argue, that the results supports the theory of diversification costs, since there is an alternative cost of excluding sin stocks. Additionally, the results are aligned with previous empirical research, which show that sin stocks outperforms comparable stock portfolios and other non-sin stock portfolios (Hong and Kacperczyk 2009; Fabozzi, Ma and Oliphant 2008; Statman and Glushkov 2009; Blitz and Fabozzi 2017). However, one potential reason that could bias the results are too few observations used when constructing stock portfolios, i.e. too few observations in both the sin- and comparable stock portfolios. Another reason could be due to omitted variable bias, e.g. the investment and profitability factors from the Fama-French five-factor model are excluded in the regression models, due to lack of data. In addition, the results implies that sin stocks tend to be low-beta stocks. This is also aligned with previous research done by Hong & Kacperczyk (2009), Fabozzi, Ma & Oliphant (2008), Statman & Glushkov (2009), Liston (2016) and Blitz & Fabozzi (2017). At last, the adjusted R^2 values are significantly lower than in previous research studies (Statman and Glushkov 2009; Liston 2016; Blitz and Fabozzi 2017). This means that the variation in the dependent variables cannot fully be explained by the regression models, i.e. omitted variable bias could affect the results.

5.3 Sin Oil Minus Comparables (SOMC)

Figure 4 (Appendix) shows that the SOMC factor has a cumulative return of approximately 190% in total during 1990-2018. It has a peak in 1993 at approximately 100%, and then drops to around 0% in 2000. After that, there is a steady upward sloping trend until 2017, with a dip in 2018.

In Table 9, the analysis is repeated using the SOMC as the dependent variable. The first regression presents that sin stocks have a one-factor alpha of 0.56% per month, which is both economically and statistically significant at the 10% level. Next, Fama-French two- and three-factor alphas equals 0.56% and 0.61%, and is both economically and statistically significant at the 10% and 5% levels, respectively. Further, the four- and five-factor alphas equals 0.47% and 0.52% and are economically significant. The five-factor alpha is statistically significant at the 10% level, but the four-factor alpha is not. Furthermore, in all five regressions in Table 9, the exposure to the market, value and beta factors are neither economically nor statistically significant even at the 10% level. The momentum factor, nonetheless, is economically and statistically significant with a negative slope at the 10% level, in regression three and four. On the other hand, the momentum factor in regression five is economically significant, but not statistically significant even at the 10% level. At last, the momentum factor is statistically significant at the 10% level in regression five and economically significant in both regression four and five with a positive sign. On top of that, the adjusted R^2 ranging between 8% to 21% in the one- and five-factor model, respectively.

Due to the statistical significant results, which does emphasize a sin stock anomaly, one can argue that not even the weak form efficiency of the EMH holds. These results are aligned with Hong & Kacperczyk (2009), Fabozzi, Ma & Oliphant (2008), Statman & Glushkov (2009) and Blitz & Fabozzi (2017). In addition, this suggests that at least some investors are irrational, which is similar to the analyses in the SMO regression (see section 5.2 SMO above). A major difference in this regression model, however, is that the oil & gas industry is included in the sin stock portfolio. Further, the sin stock portfolio constitutes of 73% of this particular industry, which could bias the results.

5.4 Sin Oil Minus Others (SOMO)

Figure 5 (Appendix) shows that the SOMO factor has a cumulative return of approximately 60% in total during 1990-2018. This is the most volatile cumulative return, with returns around 0% during 1990-2003 and then a huge peak at 120% during 2003-2008. At last, it drops again to 60% in total in 2018.

In Table 10, the analysis is repeated using the SOMO as the dependent variable. The first regression presents that sin stocks have a one-factor alpha of 0.10% per month, which is neither economically nor statistically significant even at the 10% level. Additionally, Fama-French two- and three-factor alphas equals 0.12% and 0.01%, respectively, and are neither economically nor statistically significant even at the 10% level. Furthermore, the four- and five-factor alphas equals 0.09% and 0.10% and are neither economically nor statistically significant even at the 10% level. In all five regressions in Table 10, the exposure to the market factor is both economically and significantly positive even at the 1% level. Further, the value factor is strongly economically and statistically significant even at the 1% level in all regressions. On the other hand, the size factor is strongly economically, but not statistically significant at the 10% level in all regressions in Table 10. At last, the momentum and beta factors are neither economically nor statistically significant at the 10% level. The adjusted R^2 ranging between 12% to 19% in the one- and five-factor model, respectively.

Due to the fact that there are no statistical significant results for the alphas, which does not support a sin stock anomaly, one can argue that at least the weak form efficiency of the EMH holds. This implies that one fails to conclude that investors are irrational, similar to the analyses in the SMC regression (see section 5.1 SMC above). An additional potential reason for the differences, could be that the oil & gas industry is included in the sin stock portfolio. The sin stock portfolio constitutes of 73% of this particular industry, which indeed could bias the results.

Figure 1: Cumulative return for sin stocks (excl. Oil & Gas industry) minus comparable stock portfolio (SMC) in the Nordics during 1990-2018

Figure 2: Cumulative return for sin stock portfolio (excl. Oil & Gas industry) minus risk-free rate in the Nordics during 1990-2018

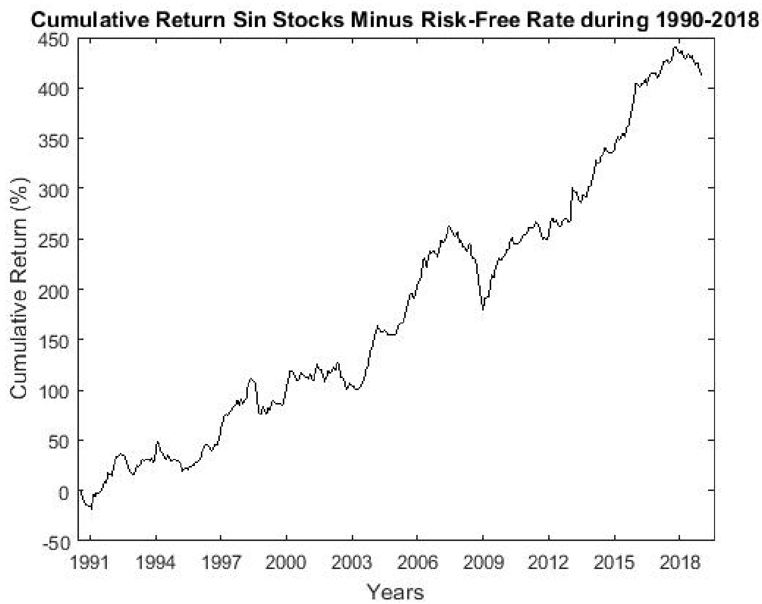

Table VII: Time-series regressions of sin stocks (excl. Oil & Gas industry) minus comparable stocks market returns (SMC) on various control variables in the Nordics

	(1)	(2)	(3)	(4)	(5)
Alpha	0.22%	0.25%	0.22%	0.37%	0.42%
	(0.67)	(0.73)	(0.65)	(1.03)	(1.15)
MKT ($R_m - R_f$)	0.24***	0.26***	0.27***	0.24***	0.25***
	(4.79)	(4.65)	(4.59)	(3.91)	(4.02)
SMB		0.38	0.38	0.37	0.42
		(1.55)	(1.52)	(1.50)	(1.65)
HML			0.08	0.09	0.12
			(0.87)	(0.97)	(1.18)
WML				-0.13	-0.10
				(-1.58)	(-1.10)
BAB					-0.09
					(-0.90)
Adjusted R^2	14.31%	25.28%	24.42%	27.37%	26.68%
No. of obs	342	342	342	342	342

Note: In this table a factor analysis is conducted using both Fama-French three-factor model as well as a momentum and beta factor. The monthly returns of the equally weighted sin stocks, (excl. Oil & Gas industry) SMC_t (Sin Minus Comparables), portfolio are conducted on the monthly factors retrieved from AQR Asset Management's data library. Regression (1) $SMC_t = \alpha + \beta_1 MKT_t + \epsilon_t$. (2) $SMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \epsilon_t$. (3) $SMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t$. (4) $SMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \epsilon_t$. (5) $SMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t$, where t=1,...,342. Significant loadings are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. T-values are presented in parentheses.

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Table VIII: Time-series regressions of sin stocks (excl. Oil & Gas industry) minus other stock portfolio returns (SMO) on various control variables in the Nordics

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Alpha	0.44%**	0.44%**	0.42%**	0.20%	0.22%
	(2.08)	(2.05)	(1.96)	(0.96)	(1.00)
MKT ($R_m - R_f$)	-0.15***	-0.15***	-0.14***	-0.10***	-0.10**
	(-4.16)	(-4.18)	(-3.78)	(-2.65)	(-2.33)
SMB		-0.07	-0.07	-0.07	-0.05
		(-0.60)	(-0.64)	(-0.58)	(-0.42)
HML			0.06	0.04	0.05
			(0.87)	(0.64)	(0.70)
WML				0.19***	0.20***
				(3.64)	(3.23)
BAB					-0.03
					(-0.36)
Adjusted R^2	9.45%	8.77%	8.52%	17.69%	16.85%
No. of obs	342	342	342	342	342

Note: In this table a factor analysis is conducted using both Fama-French three-factor model as well as a momentum and beta factor. The monthly returns of the equally weighted sin stocks, (exlc. Oil & Gas industry) SMO_t (Sin Minus Others), portfolio are conducted on the monthly factors retrieved from AQR Asset Management's data library. Regression (1) $SMO_t = \alpha + \beta_1 MKT_t + \epsilon_t$. (2) $SMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \epsilon_t$. (3) $SMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t$. (4) $SMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \epsilon_t$. (5) $SMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t$, where t=1,...,342. Significant loadings are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. T-values are presented in parentheses.

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Table IX: Time-series regressions of sin stocks (incl. Oil & Gas industry) minus comparable stock market returns (SOMC) on various control variables in the Nordics

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Alpha	0.56%*	0.56%*	0.61%**	0.47%	0.52%*
	(1.91)	(1.90)	(2.06)	(1.58)	(1.71)
MKT ($R_m - R_f$)	-0.01	-0.01	-0.03	0.00	0.01
	(-0.21)	(-0.19)	(-0.58)	(-0.09)	(0.14)
SMB		0.00	0.02	0.02	0.07
		(0.02)	(0.14)	(0.15)	(0.46)
HML			-0.15*	-0.16*	-0.14
			(-1.68)	(-1.82)	(-1.49)
WML				0.12	0.15*
				(1.57)	(1.74)
BAB					-0.09
					(-0.99)
Adjusted R^2	8.22%	8.05%	15.58%	17.45%	20.89%
No. of obs	342	342	342	342	342

Note: In this table a factor analysis is conducted using both Fama-French three-factor model as well as a momentum and beta factor. The monthly returns of the equally weighted sin stocks, (inlc. Oil & Gas industry) $SOMC_t$ (Sin Oil Minus Comparables), portfolio are conducted on the monthly factors retrieved from AQR Asset Management's data library. Regression (1) $SOMC_t = \alpha + \beta_1 MKT_t + \epsilon_t$. (2) $SOMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \epsilon_t$. (3) $SOMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t$. (4) $SOMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \epsilon_t$. (5) $SOMC_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t$, where t=1,...,342. Significant loadings are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. T-values are presented in parentheses.

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Table X: Time-series regressions of sin stocks (incl. Oil & Gas industry) minus other stock portfolio returns (SOMO) on various control variables in the Nordics

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Alpha	0.10%	0.12%	0.01%	0.09%	0.10%
	(0.38)	(0.46)	(0.05)	(0.32)	(0.37)
MKT ($R_m - R_f$)	0.11***	0.13***	0.17***	0.15***	0.16***
	(2.69)	(2.81)	(3.57)	(3.09)	(3.06)
SMB		0.33	0.30	0.30	0.32
		(1.60)	(1.45)	(1.43)	(1.45)
HML			0.31***	0.31***	0.32***
			(4.47)	(4.52)	(4.48)
WML				-0.06	-0.06
				(-0.96)	(-0.34)
BAB					-0.03
					(-0.34)
Adjusted R^2	11.75%	13.12%	18.99%	19.21%	18.52%
No. of obs	342	342	342	342	342

Note: In this table a factor analysis is conducted using both Fama-French three-factor model as well as a momentum and beta factor. The monthly returns of the equally weighted sin stocks, (incl. Oil & Gas industry) $SOMO_t$ (Sin Oil Minus Others), portfolio are conducted on the monthly factors retrieved from AQR Asset Management's data library. Regression (1) $SOMO_t = \alpha + \beta_1 MKT_t + \epsilon_t$. (2) $SOMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \epsilon_t$. (3) $SOMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_t$. (4) $SOMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \epsilon_t$. (5) $SOMO_t = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 WML_t + \beta_5 BAB_t + \epsilon_t$, where t=1,...,342. Significant loadings are indicated by *** for the 1% level, ** for the 5% level and * for the 10% level. T-values are presented in parentheses.

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6 Conclusion

Results from prior research studies indicate an outperformance of sin stocks, while evidence on the financial performance of socially responsible investing remains mixed. In this study, the results are mixed. Moreover, they show support for hypotheses H2 and H3, that sin stocks (in the SMO and SOMC factors) outperform non-sin stock portfolios, and thus indicate that a sin stock anomaly is present. These results are similar to Hong & Kacperczyk (2009), Blitz & Fabozzi (2017), Fabozzi, Ma & Oliphant (2008), Statman & Glushkov (2009) and Salaber (2007). However, the results do not show support for hypotheses H1 and H4, that the sin stocks (in the main dependent variable SMC and the SOMO variable) do not outperform non-sin stocks portfolios. This means that one fails to reject the null hypothesis that there is a sin stock anomaly in these regressions. Furthermore, these results are similar to Lobe and Walkshäusl (2016). On top of that, it is hard to conclude whether the theoretical frameworks are supported or violated in this thesis, i.e. if the EMH, arbitrage theory and diversification theory holds.

In addition, there is a current trend (in the Nordics) that investors focuses on sustainable investments and thus have an exclusion policy that does not allow investments in sin stocks. My findings do not prove a sin stock anomaly in the Nordic stock market. This, however, does not imply that a sin stock exclusion policy has no effects on financial performance. As long as sin stocks have positive exposures to the Fama-French factors that are rewarded with positive premiums, their raw expected return remains higher than the expected market return. Consequently, excluding these stocks will have a negative impact for investors' expected portfolio return.

Only due to the fact that this study does not show support for a sin stock anomaly on the Nordic stock market during the last 30 years, simply does not mean that this will hold for the upcoming 30 years. One needs to be careful to draw too strong conclusions or argue for causation in this case. Moreover, the financial markets have changed dramatically over time and are always evolving. One example of this could be negative interest rates in Sweden, something that have unsettled the whole rationality within financial theory. Events like this will obviously affect the stock market and the whole economy as well. Thus, what has driven stock returns historically might change over time for upcoming years.

6.1 Future Research

It would be of huge interest to include cannabis stocks in the sin stock portfolio in future research, when more data is available from that industry. It is also encouraged to include the Fama-French five-factor model which includes the profitability factor RMW and the investment factor CMA, when data is available from the Nordic stock market. In addition, it would be interesting to divide the time series data in two or three different time series, to see if the results differ. At last, it would be interesting to investigate whether there are differences in ownership, both between different types of investors, but also between the Nordics and other parts of the world.

References

Akerlof, G., 1980. A theory of social custom, of which unemployment may be one consequence. Quarterly Journal of Economics 94, 749-775.

Altonji, J., Blank, R., 1999. Race and gender in the labor market. In: Card, D., Ashenfelter, O. (Eds.), Handbook of Labor Economics, vol. 3c. North-Holland, Amsterdam, pp. 3143–3259.

AQR Asset Management, 2019. Betting Against Beta: Equity Factors Data, Monthly. [Accessed: 2019-07-02]. https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly

Becker, G., 1957. The Economics of Discrimination. University of Chicago Press, Chicago.

Berman, D., 2002. Why sin is good: tobacco, alcohol, and gaming stocks can add sizzle to your portfolio? Money Sense, November.

Blitz, D., Fabozzi, J. F., 2017. Sin Stocks Revisited: Resolving the Sin Stock Anomaly. The Journal of Portfolio Management 44.

Connaker, A., Madsbjerg, S., 2019. The State of Socially Responsible Investing. Harvard Business Review.

Fabozzi, J. F., Ma, C. K., Oliphant, J. B., 2008. Sin Stock Returns. The Journal of Portfolio Management 35, 82-94.

Fama, F. E., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance 25, 383-417.

Fama, F. E., French, R. K., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3-56.

Fama, F. E., French, R. K., 1997. Industry costs of equity. Journal of Financial Economics 43, 153-193.

Fama, F. E., French, R. K., 2015. A five factor asset pricing model. Journal of Financial Economics 116, 1-22.

Fama, R. E., MacBeth, J., 1973. Risk, return, and equilibrium: empirical test. Journal of Political Economy 81, 607-636.

Frazzini, A., Pedersen, H. L., 2014. Betting against beta. Journal of Financial Economics 111, 1-25.

Geczy, C., Stambaugh, R., Levin, D., 2003. Investing in socially responsible mutual funds. Unpublished Working Paper, University of Pennsylvania, Wharton.

Glaeser, E., Scheinkman, J., 2003. Non-market interactions. In: Dewatripont, M., Hansen, L., Turnovsky, S. (Eds.), Advances in Economics and Econometrics: Theory and Applications, Eight World Congress. Cambridge University Press, Cambridge, pp. 339–370.

Hong, H., Kacperczyk, M., 2009. The price of sin: The effects of social norms on markets. Journal of Financial Economics 93, 15-36.

Levitt, S., 2004. Testing theories of discrimination: evidence from weakest link. Journal of Law and Economics 47, 431–452.

Lintner, J., 1965. The Valuation of Risk and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. The Review of Economics and Statistics 47, 13-37.

Liston, P. D., 2016. Sin stock returns and investor sentiment. The Quarterly Review of Economics and Finance 59, 63-70.

Lobe, S., Walkshäusl, C., 2016. Vice versus virtue investing around the world. Review of Managerial Science 10, 303-344.

Merton, R., 1973. Theory of rational option pricing. Bell Journal of Economics and Management Science 4 (1), 141–183.

Merton, R., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483-510.

Mossin, J., 1966. Equilibrium in a Capital Asset Market. Econometrica 34, 768-783.

Roll, R., Ross, A. S., 1980. An Empirical Investigation of the Arbitrage Pricing Theory. Journal of Finance 35, 1073-1103.

Salaber, J., 2007. The Determinants of Sin Stock Returns: Evidence on the European Market. AFFI - Paris Finance International Meeting.

Sharpe, F. W., 1964. Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. Journal of Finance 19, 425-442.

Sharpe, F. W., 1972. Risk, Market Sensitivity and Diversification. Financial Analysts Journal 28, 74-79.

Sharpe, F. W., 1995. Risk, Market Sensitivity and Diversification. Financial Analysts Journal 51, 84-88.

Sharpe, F. W., Alexander, G., 1990. Investments, 4th edition. Prentice Hall, Englewood Cliffs, N.J.

Shliefer, A., Vishny, W. R., 1997. The Limits of Arbitrage. The Journal of Finance 52, 35-55.

Social Investment Forum., 2019. Forum for Sustainable and Responsible Investment. Accessed online: 2019-08-10. https://www.ussif.org/join

Statman, M., Glushkov, D., 2009. The Wages of Social Responsibility. Financial Analysts Journal 65, 33-46.

Wooldridge, M. J., 2015. Introduction to Econometrics. Hampshire: Cengage.

Appendix

Figure 3: Cumulative return for sin stocks (excl. Oil & Gas industry) minus other stock portfolio (SMO) in the Nordics during 1990-2018

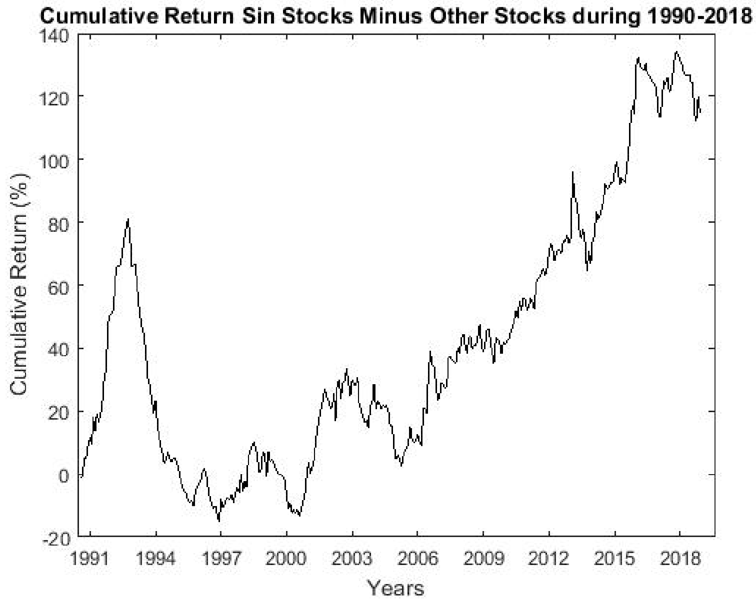

Figure 4: Cumulative return for sin stocks (incl. Oil & Gas industry) minus comparable stock portfolio (SOMC) in the Nordics during 1990-2018

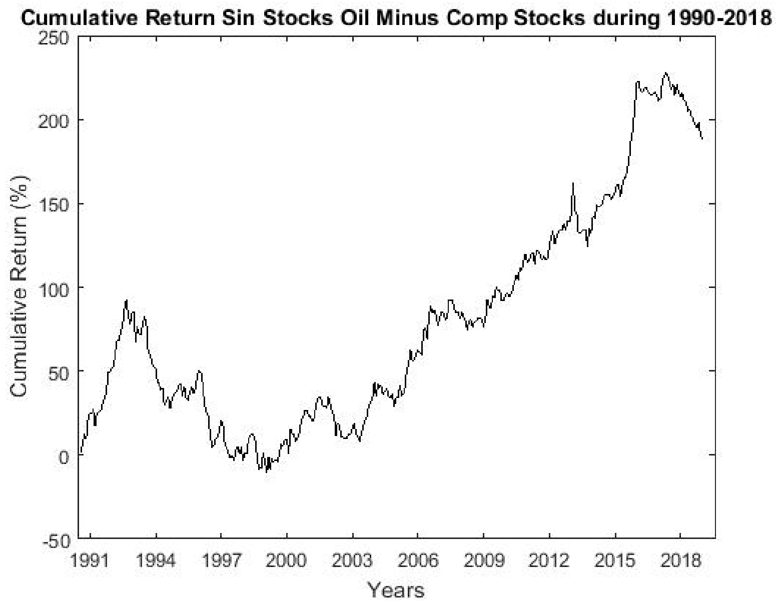

Figure 5: Cumulative return for sin stocks (incl. Oil & Gas industry) minus other stock portfolio (SOMO) in the Nordics during 1990-2018

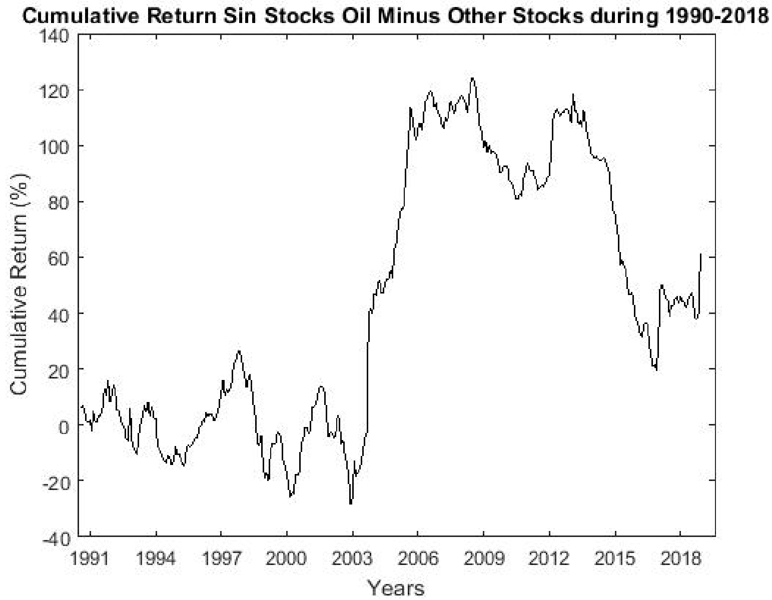

Figure 6: Cumulative return for sin stock portfolio (incl. Oil & Gas industry) minus risk-free rate in the Nordics during 1990-2018

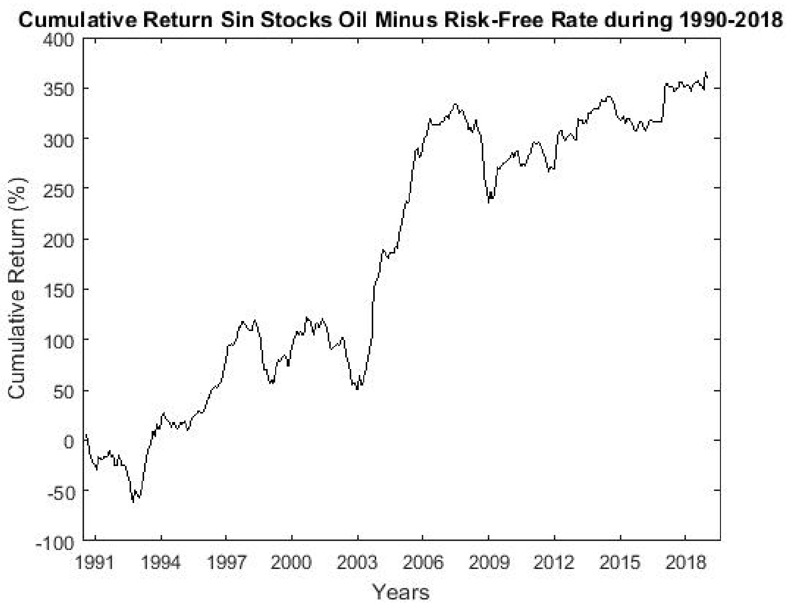

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Table XI: Distribution of the sin stock portfolio (excl. Oil & Gas industry). This table shows the sin stock portfolio during 1990-2018 distributed by industry

Year	All	Alcohol	Tobacco	Gambling	Weapons
1990	5	5	0	0	0
1991	6	6	0	0	0
1992	6	6	0	0	0
1993	7	6	0	0	1
1994	9	7	0	0	2
1995	9	7	0	0	2
1996	11	7	1	1	2
1997	12	7	1	1	3
1998	14	7	1	2	4
1999	14	7	1	2	4
2000	14	7	1	2	4
2001	13	7	1	2	3
2002	12	6	1	2	3
2003	10	4	1	2	3
2004	11	4	1	2	4
2005	14	4	1	3	6
2006	16	4	1	5	6
2007	20	4	1	6	9
2008	21	4	1	7	9
2009	22	4	1	8	9
2010	22	4	1	8	9
2011	22	5	1	8	8
2012	24	6	1	8	9
2013	25	6	1	9	9
2014	26	6	1	10	9
2015	26	6	1	11	8
2016	28	6	2	11	9
2017	32	8	2	12	10
2018	33	8	2	14	9
Total	41	11	2	15	13

Table XII: Distribution of the sin stock portfolio (incl. Oil & Gas industry). This table shows the sin stock portfolio during 1990-2018 distributed by industry

Year	All	Alcohol	Tobacco	Gambling	Weapons	Oil & Gas
1990	17	5	0	0	0	12
1991	18	6	0	0	0	12
1992	19	6	0	0	0	13
1993	20	6	0	0	1	13
1994	23	7	0	0	2	14
1995	25	7	0	0	2	16
1996	31	7	1	1	2	20
1997	38	7	1	1	3	26
1998	43	7	1	2	4	29
1999	43	7	1	2	4	29
2000	42	7	1	2	4	28
2001	44	7	1	2	3	31
2002	43	6	1	2	3	31
2003	39	4	1	2	3	29
2004	41	4	1	2	4	30
2005	55	4	1	3	6	41
2006	66	4	1	5	6	50
2007	82	4	1	6	9	62
2008	84	4	1	7	9	63
2009	80	4	1	8	9	58
2010	76	4	1	8	9	54
2011	76	5	1	8	8	54
2012	78	6	1	8	9	54
2013	82	6	1	9	9	57
2014	83	6	1	10	9	57
2015	83	6	1	11	8	57
2016	80	6	2	11	9	52
2017	83	8	2	12	10	51
2018	79	8	2	14	9	46
Total	153	11	2	15	13	112

Table XIII: Distribution of the comparable stock portfolio (incl. Food, Soda, Fun and Meals & Hotels industries). This table shows the comparable stock portfolio during 1990-2018 distributed by industry

Year	All	Food	Soda	Fun	Meals & Hotels
1990	7	4	0	1	2
1991	7	4	0	1	2
1992	8	4	0	2	2
1993	8	4	0	2	2
1994	10	5	0	2	3
1995	10	5	0	2	3
1996	12	6	0	2	4
1997	17	8	0	2	7
1998	18	8	0	2	8
1999	20	9	1	2	8
2000	20	8	1	2	9
2001	19	8	1	2	8
2002	18	8	1	2	7
2003	17	7	1	1	8
2004	17	6	1	2	8
2005	17	6	1	2	8
2006	18	6	1	2	9
2007	21	7	1	4	9
2008	20	7	1	4	8
2009	20	7	1	5	7
2010	20	7	1	5	7
2011	19	7	1	5	6
2012	17	6	0	5	6
2013	18	7	0	5	6
2014	19	7	0	5	7
2015	20	7	0	5	8
2016	21	8	0	5	8
2017	20	7	0	5	8
2018	20	7	0	5	8
Total	39	15	1	5	18

Table XIV: Correlation Matrix

	SMC	SMO	SOMC	SOMO	MKT	SMB	HML	WML	BAB
SMC	1.00								
SMO	-0.02	1.00							
SOMC	0.54	0.63	1.00						
SOMO	0.75	0.10	0.13	1.00					
MKT	0.22	-0.22	-0.01	0.14	1.00				
SMB	0.10	-0.01	0.00	0.14	-0.14	1.00			
HML	0.00	0.10	-0.09	0.19	-0.23	0.09	1.00		
WML	-0.14	0.25	0.08	-0.08	-0.30	0.03	0.14	1.00	
BAB	-0.01	0.05	-0.04	0.07	0.00	0.32	0.27	0.35	1.00

Note: This table presents the correlation between the variables used in the OLS models. The table shows that there is no perfect correlation between the variables.