

SHOULD YOU SIN?

**SIN STOCK OVER-PERFORMANCE IN THE AGE OF SOCIALLY
RESPONSIBLE INVESTING**

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Should You Sin? : Sin Stock Over-performance in the Age of Socially Responsible Investing

Abstract:

This thesis presents evidence that the phenomenon of sin stocks yielding abnormal returns persists until the present day. In contrast to results by Blitz and Fabozzi (2017), we find these abnormal returns to be robust to controlling for the Fama-French factors for profitability and investment. The study is carried out on 156 American alcohol, tobacco, and gambling stocks during the period 1985 through 2018, and each of these sin industries is found to exhibit abnormal returns. Furthermore, the magnitude of these abnormal returns is found to be increasing over time. This increase may stem from a rise in socially responsible investment and other screening procedures among investment professionals, which causes shunning of sin stocks.

Keywords:

Sin stocks, sin investing, vice funds, socially responsible investing, abnormal returns, social norms, neglected stocks

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Contents

1.	INTRODUCTION	3
2.	BACKGROUND	6
3.	DATA.....	10
3.1.	Selection of Sin Stocks.....	10
3.2.	Construction of sin and comparable portfolio.....	11
3.3.	Market portfolio and risk factors.	13
4.	THEORY.....	15
4.1.	Asset pricing models.....	15
4.2.	Choice of comparables	17
5.	EMPIRICAL RESULTS	18
5.1.	Factor Regressions	18
5.1.1.	Factor analysis.....	18
5.1.2.	Removing Tobacco.....	21
5.2.	Is the sin stock anomaly resolved?	21
5.2.1.	Six-factor regression.....	22
5.2.2.	Six-factor regression including defense stocks	22
5.3.	Variation with time regressions	24
5.4.	Long-short portfolio	27
5.4.1.	Choice of comparables	27
5.4.2.	Comparables study	28
5.5.	Robustness tests	31
6.	CONCLUSION.....	33
7.	REFERENCES	35

1. Introduction

Social norms are informal rules that govern what is acceptable and unacceptable behavior in groups and societies. Socially Responsible Investing (SRI), an investment strategy where investors use “sin” screens when constructing portfolios of stocks, is an example of social norms influencing investor behavior. In practice this means that investment professionals either exclude firms from their portfolios which engage in activities that violate social norms or only invest in best-in class socially conscious companies (Richey, 2014). Socially responsible investing represents 26 per cent of all professionally managed assets today (US Forum for Sustainable and Responsible Investment, 2018). This represents an 18-fold increase since 1995.

Interestingly, despite the increasing popularity of socially responsible investing, socially responsible assets have not been found to provide abnormal returns. According to Hamilton, Jo, and Statman (1993) the performance of socially responsible funds do not statistically differ from the performance of conventional funds. Furthermore Ciciretti, Ambrogio, and Lammertjan (2017) estimate the underperformance of socially responsible funds to be 4.8 per cent annually.

In tandem with the rise of socially responsible investing, a new investment niche has also arisen called “sin investing”. Sin investing involves investment in assets that are often shunned by SRI funds such as the “Sin Triumvirate”: alcohol, gambling and tobacco stocks. Intriguingly, sin stocks have been consistently found to deliver positive risk-adjusted abnormal returns relative to comparable assets in the United States and in major European economies (e.g. Germany, United Kingdom, France, Spain) (Salaber, 2007; Hong & Kacperczyk, 2009).

Several mechanisms have been proposed to explain the over-performance of sin stocks. The prevailing explanation in current literature is that sin stocks are systematically underpriced because large norm-constrained investors (e.g. pension funds) choose to shun them (Merton, 1987). Another explanation is that the increased litigation risk associated with sin stocks, which is further amplified by certain social norms, should result in higher required returns for such stocks (Hong & Kacperczyk, 2009).

The recent upsurge in popularity of SRI can be viewed as a reflection of strengthening social norms. This trend could be indicative of ethical considerations playing a larger role in investment decisions than during previous periods. If this is the case, more investment professionals will have aversions to investing in firms producing harmful products such as alcohol, tobacco and gambling. It is therefore interesting to investigate if that has led to a rising neglect of sin-stocks and as proposed by Merton (1987) higher abnormal returns for sin stocks.

To our knowledge, no studies have explicitly examined the evolution of the sin stock over-performance over time. This work will thus investigate whether the sin stock over-performance phenomenon is still present up until the modern day and whether the magnitude of sin stock over-performance has increased between 1985 and 2018 on the US stock market.

First, using time-series regressions for the period of 1985-2018, we find that a sin portfolio comprised of US alcohol, gambling and tobacco stocks shows abnormal returns. This is robust to adjusting for a four-factor model consisting of the Fama-French size and value factors as well as the Carhart momentum factor. Recent studies have found that the abnormal returns associated with sin stocks vanishes when accounting for the Fama-French quality factors – profitability and investment (Richey, 2017; Blitz & Fabozzi, 2017). To check if our results are robust to the addition of these two factors, we do a regression under a six-factor framework. We find, unlike Richey (2017) and Blitz and Fabozzi (2017), a positive monthly alpha of 124 basis points which is statistically significant at the 1 per cent level.

Running similar regressions for the time-periods 1985-1995, 1996-2006 and 2017-2018 we find that the abnormal returns of the sin portfolio increases over the respective time periods. The monthly alpha in the first time period is 101 basis points, followed by 145 basis points in the second period, and, finally, 159 basis points in the final time period. All these values are statistically significant at the 1 per cent level.

Our results are consistent with the majority of previous literature and indicates that sin stocks show abnormal returns for US stocks (Salaber, 2009; Hong & Kacperczyk, 2009; Liston & Soydemir, 2010). In addition, our result shows that this phenomenon is present in modern times (2007-2018) and that the abnormal returns of sin stocks are increasing

over time. However, a conclusion cannot be drawn with respect to the question of whether this increase in abnormal returns is the result of increased shunning of sin stocks (Merton, 1987). Another viable explanation is that the explanatory variables are weakening in their ability to capture abnormal returns (Barillas & Shanken, 2018).

The underpricing of sin stocks has significant implications for the governance of companies within the relevant industries. As a result of this underpricing, there is less equity funding available to sin firms relative to comparables. Therefore Hong and Kacperczyk (2009) advise such firms to finance their business with a relatively higher proportion of debt. If the magnitude of sin stock underpricing is increasing as our results show, then management of sin firms should rely even more on debt to finance their firms. Furthermore, from an investor perspective, an investor willing to invest in sin stocks may enjoy significant abnormal returns to their investment. A portfolio which holds sin stocks long and their comparables short does not only yield high abnormal returns, but it is also almost completely uncorrelated to the performance of the market portfolio (beta neutral). Finally, our results indicate that the sin stock anomaly has not been resolved by controlling for the Fama and French factors for profitability and investment, as claimed by Blitz and Fabozzi (2017).

2. Background

Hong and Kacperczyk (2009) studied sin stocks in the American stock market and found that sin stocks significantly outperformed both the market at large and a portfolio of what they consider to be comparable stocks. Their study demonstrated that an equal-weighted portfolio holding sin stocks long and their comparables short yielded a statistically significant abnormal returns during the period 1926 to 2006. Even when controlling for the Fama and French factors for momentum, size, and value, such a portfolio was shown to yield an average excess return of approximately 3.5 per cent per annum.

Furthermore, Hong and Kacperczyk (2009) showed that socially conscious investors (e.g. pension funds) were less likely to hold positions in sin stocks, while investors subject to more opaque governance structures (e.g. hedge funds) were more likely to hold positions in sin stocks. Moreover, they find that sin stocks were given more infrequent coverage by stock analysts than non-sin stocks with similar characteristics. In summary, they suggest that adherence to social norms may be what is causing the systematic over-performance of sin stocks in the American stock market.

Salaber (2007) studied the returns of the alcohol, tobacco, and gambling sectors in 18 European countries and found that while sin stocks significantly outperform the market, their litigation risk is also higher. She found that the return of sin stocks in relation to the rest of the market depended on both the regulatory and the religious circumstances of the country in which the stocks are traded. Interestingly, she demonstrates that Catholics are more willing to hold sinful stocks than Protestants, who require a significant premium for holding sin stocks over comparable assets.

Salaber (2009) provided evidence of American sin stock performance during recessions. This study finds statistically significant evidence that sin stocks outperformed the market by approximately 3.7 percent per year during recessions, and that a portfolio holding sin stocks long and their comparables short outperformed the market by approximately 2.3 percent per year.

Sin stock performance in Chinese markets has been studied by Visaltanachoti, Zheng, and Zou (2011), who find that sin stocks in mainland China and in Hong Kong outperform the market during the period from 1995 through 2008. Their results indicate that sin stocks

outperform the market index by 5.9 percent per annum in mainland China and 29.1 percent per annum in Hong Kong, which is consistent with similar studies conducted on the US and European markets. Out of the 46 companies included in their sample, 32 companies yielded significant abnormal risk-adjusted returns over the studied period.

The performance of sin stocks in relation to SRI has been studied by Liston and Soydemir (2010). They find that a portfolio of sin stocks outperforms a portfolio consisting solely of socially good and faith-based stocks. Their results indicate positive Jensen's alpha for the sin portfolio and negative Jensen's alpha for the faith-based and socially good portfolio. Moreover, they find that the market betas of the two portfolios tend to diverge and move in opposite directions over the sample period. Finally, the Sharpe ratio for the sin portfolio is statistically higher than the Sharpe ratio for the faith-based portfolio.

Further investigation of the relationship between SRI and sin stocks has been provided by Statman and Glushkov (2008). They provide evidence that any advantage possessed by socially responsible investors, i.e. investors only willing to hold assets ranked highly in social responsibility, is largely offset by their unwillingness to hold sin stocks, which they find to outperform the market index.

Richey (2014) looks at the performance of a sin portfolio composed of alcohol, gambling, tobacco and defense stocks over the period 2007-2013. He finds that the sin portfolio and each of the sub-indices do not generate statistically significant alphas under the CAPM, three-factor or Carhart-four factor models. He does find that in a bear market the sin portfolio and all of the sub-indices except tobacco yield positive and significant alphas. In a bull market, he finds that the sin portfolio yields significant alphas under the three factor and four-factor models but not under the CAPM.

Richey (2017) studies the return performance of a sin portfolio consisting of US stocks in the alcohol, tobacco, gambling, defense and adult entertainment industries over the period 1996 to 2016. He finds positive and significant alphas under the CAPM, Fama-French Three Factor model, and the Carhart Four-Factor model. Interestingly, he finds that under a five-factor model controlling for the Fama-French factors for investment and profitability the significance of alpha disappears.

Blitz and Fabozzi (2017) also report that the sin stock phenomenon completely disappears when controlling for the Fama-French factors for investment and profitability. They argue that it is the high profitability and conservative investment strategies among sin stocks that have been causing the abnormal returns, rather than any moral considerations among investors. Their regression results do not yield any alpha which is significantly different from zero, and they find this to hold true for alcohol, tobacco, and defense stocks during the period 1963 through 2016.

In summary, most previous literature (see Table 1) has found statistically significant evidence of sin stocks outperforming the market, even when adjusting for risk, momentum, size, and value factors. This has been shown to hold true in American, European, and Chinese markets. Moreover, this phenomenon has been found to be present in time periods spanning from 1926 into the early 2010's. It has been hypothesized that this phenomenon mainly stems from the unwillingness of certain participants in the market to buy sin stocks. However, both Richey (2017) and Blitz and Fabozzi (2017) report that abnormal returns among sin stocks disappear when controlling for profitability and investment. When controlling for these factors, they do not find statistically significant alphas.

Table 1- This table shows the previous literature on sin stocks. Shown are the markets, time periods and “sin” industries examined. The alpha (%) column shows the monthly alphas of the sin portfolios obtained under the CAPM and multi-factor models respectively. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively.

Authors	Market	Period	Sin Industries	Weight	Alpha (%)	
					CAPM	Multi-Factor
Fabozzi et al. (2008)	Global	1970-2007	Sin Triumvirate, Adult Entertainment, Defense, Biotech	Equal	0.96	N.A
Statman & Glushkov (2008)	US	1992-2007	Sin Triumvirate, Defense, Nuclear Power	Equal	0.27**	0.19
Hong & Kacperczyk (2009)	US	1960-2006	Sin Triumvirate	Equal	0.25*	0.26**
Salaber (2007)	Europe	1975-2006	Sin Triumvirate	Equal	N.A	0.33*
Salaber (2009)	US	1926-2006	Sin Triumvirate	N.A	N.A	0.30***
Visaltanachoti et al. (2009)	China, Hong Kong	1995-2007	Sin Triumvirate	Equal	0.50*** 2.43***	N.A
Liston & Soydemir (2010)	US	2001-2007	Sin Triumvirate	Equal	0.082	N.A
Lobe & Walkshäusl (2011)	Global	1995-2007	Sin Triumvirate, Adult Entertainment, Nuclear power, Defense	Equal	0.18	0.02
Richey (2014)	US	2007-2013	Sin Triumvirate, Defense,	Equal	0.002	0.002
Richey (2017)	US	1996-2016	Sin Triumvirate, Defense, Adult Entertainment	Price	0.029*	0.010
Blitz and Fabozzi (2017) ¹	US, Europe, Japan & Global	1963-2016	Sin Triumvirate, Defense	Value	0.47**	0.10

¹ The values presented are for the US market.

3. Data

3.1. Selection of Sin Stocks

There exists no formal definition of sin stocks. This is because the notion of what is sinful varies over time and differs depending on the cultural context studied. This paper will focus on the traditional “Triumvirate of Sin”: alcohol, tobacco and gambling stocks for three reasons. Firstly, in the United States, firms in these respective industries are conventionally seen as engaging in sinful activities (Salaber, 2007; Hong & Kacperczyk, 2009). This is because alcohol, gambling, and tobacco consumer products possess addictive properties and frequently lead to harmful social consequences when their usage is abused. Moreover, these products or services can often be viewed as an offense against religious or moral law (Kim & Venkatachalam, 2011). Secondly, most of the previous literature on sin stocks have at least focused on the alcohol, tobacco and gambling industries, see Table 1. This facilitates comparison and discussion with respect to past results. Thirdly, most funds in the United States engaged in SRI traditionally screen out firms in the alcohol, tobacco, gambling, defense and adult entertainment industries (Statman, 2000). The adult entertainment industry has been excluded in our analysis due to data availability issues. Only a small subset of its companies are listed on public exchanges. With respect to the defense industry, there exists uncertainty about whether it is conventionally viewed as sinful or not. In addition, it is possible that the returns of defense stocks are influenced by factors such as government spending and the geopolitical climate (U.S. Bureau of Economic Analysis , 2018). We have thus decided to exclude it from our main analysis.

3.2. Construction of sin and comparable portfolio

This study consists of a US sample for the period 1960-2018. The CRSP database is used to obtain US monthly returns for NYSE, AMEX, and NASDAQ stocks. To identify stocks that belong to the alcohol, tobacco and gambling industries respectively, we use the Fama-French 48 industry classification which categorizes industries based on their SIC codes. Alcohol stocks are found in the industry group 4 (SIC codes 2100-2199). Tobacco stocks are found in industry group 5 (SIC codes 2080-2085). Gambling stocks are not separated from meals & hotels and entertainment stocks in the SIC classification scheme. As a consequence, to identify gambling stocks, the North American Industry Classification system (NAICS) is used. Gambling stocks have the following NAICS code: 7132, 71312, 713210, 71329, 713290, 72112, and 721120.

Through this above process CRSP generates monthly return for a total of 376 unique firms of which 157 are identified as alcohol firms, 86 are identified as tobacco firms and 133 are identified gambling firms. We then screen this obtained list to ensure that each firm is primarily involved in the production of alcohol, gambling and tobacco consumer products. Furthermore, since there is only reliably available data for gambling firms from 1985 and onwards, we limit the range of the main analysis to the period 1985-2018. Finally, we exclude any firm that is wholly inactive during the period 1985-2018. Through the above screening mechanisms, we obtain monthly return data for a total of 136 unique firms of which 56 are alcohol firms, 26 are tobacco firms and 54 are gambling firms.

From the collected data, we have constructed an equally-weighted portfolio called SINDEX consisting of the 136 identified US sin companies for the period 1985-2018. The reason for creating an equally-weighted portfolio is because most of the previous literature has done so (see Table 1) which facilitates comparison with previous results. Furthermore, from the acquired data, three equally weighted portfolios for the respective sub-indices are formed called ALCOHOL, GAMBLING and TOBACCO. The average number of active companies each year in each of these sub-indices is presented in Table 2.

From CRSP, we also obtain monthly return data for defense stocks during the period 1985-2018. Defense stocks are found in industry group 26 and have the following SIC

codes: 3480-3489, 3760-3769 and 3795. We also construct an equally weighted portfolio of defense stocks. This is done for the purpose of robustness tests later in the analysis, see 5.2.2. Six-factor regression including defense stocks

In part of the analysis the performance of sin stocks will be tested against comparable industries. The comparable portfolio consists of the following industries from the Fama and French 48-industry classification: Food, Fun, Meals & Hotels and Soda (see section 5.4.1 for choice of comparables). Using the process mentioned above, an equally weighted portfolio consisting of comparable stocks called COMPDEX is created.

Table 2 - The table shows the average number of active stocks within the Alcohol, Gambling and Tobacco industries in the CSRP database for each year during the period 1985-2018.

YEAR	Alcohol	Tobacco	Gambling	YEAR	Alcohol	Tobacco	Gambling
1985	12	6	4	2002	13	6	22
1986	11	6	4	2003	13	6	23
1987	10	5	4	2004	12	6	23
1988	9	5	4	2005	11	6	22
1989	10	5	5	2006	11	6	21
1990	10	5	6	2007	11	6	20
1991	10	5	7	2008	11	7	18
1992	9	5	7	2009	9	6	17
1993	9	5	10	2010	10	6	17
1994	10	5	17	2011	10	6	17
1995	11	5	18	2012	11	6	17
1996	17	6	19	2013	11	6	17
1997	19	8	19	2014	10	6	15
1998	19	8	19	2015	10	6	14
1999	18	7	20	2016	10	6	13
2000	15	6	20	2017	10	6	12
2001	13	6	20	2018	10	5	12

3.3. Market portfolio and risk factors.

The market portfolio used in our analysis is the monthly value-weighted return of all CRSP firms incorporated in the US and listed on the NASDAQ, AMEX or NYSE exchanges. This data was supplied by Kenneth R French through his data library (French, 2019). From Kenneth French's website we also obtain monthly return data for the return of the market portfolio sans the risk-free rate (MKT), size (SMB), value (HML), momentum (MOM), profitability (RMW) and investment (CMA) factors which are used in the regression analysis. The summary statistics for the data used in this thesis is presented in Table 3.

Table 3 - This table shows the descriptive statistics for the time-series regression run for the period 1985-2018. The mean monthly return and the standard deviations for the monthly returns are given for the sin portfolio, SINDEXX as well as the sub-indices, ALCOHOL, TOBACCO, and GAMBLING. In addition, the mean monthly return and the standard deviations are reported for the comparable portfolio COMPDEX as well as each of the sub-industries FOOD, FUN, SODA and MEALS & HOTELS. The monthly returns data is retrieved from the CSRP database. Finally, the monthly mean values and the standard deviations for the explanatory variables are presented. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance, RMW is the return difference between stocks with robust profitability and stocks with weak profitability, and CMA is the return difference between stocks with conservative investment and stocks with aggressive investment. The data for the explanatory variables is retrieved from K. French's data library.

Variable	Mean (%)	Standard deviation (%)	No. of obs.
SINDEXX	1.68	5.58	401
ALCHOL	1.67	6.61	401
TOBACCO	1.16	6.12	401
GAMBLING	1.76	8.89	401
COMPDEX	0.95	5.92	401
FOOD	1.1	4.34	401
FUN	0.5	6.78	401
SODA	1.3	6.09	401
MEALS & HOTELS	0.89	5.92	401
MKT - RF	0.66	4.38	401
SMB	0.04	3.09	401
HML	0.18	2.87	401
MOM	0.54	4.51	401
RMW	0.35	2.47	401
CMA	0.25	2.01	401

4. Theory

4.1. Asset pricing models

The capital asset pricing model (CAPM) postulates that only non-diversifiable market risk should be priced. The model was developed by Sharpe (1964) and Lintner (1965) and is frequently used for measuring the performance of stocks. CAPM is estimated through the following regression model.

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i MKT_{rf,t} + \varepsilon_{i,t} \quad (1)$$

where $r_{i,t} - r_{f,t}$ is the total return of asset i during period t sans the risk-free rate during period t , $MKT_{rf,t}$ is the total return of the market portfolio during period t sans the risk-free rate, and $\varepsilon_{i,t}$ is a zero-mean error term for asset i during the period t .

The model is used for calculating the intercepts α_i , known as Jensen's alpha, which measures the abnormal returns of an asset, and the β_i coefficients, which represents an asset's exposure to systematic risk.

The CAPM was expanded upon by Fama and French (1993). Following work on the relationship between stock returns and size by Banz (1981) and the relationship between stock returns and book-to-market ratios by Rosenberg, Reid, and Lanstein (1985), Fama and French developed a three-factor model which includes the market factor used in the CAPM, a size factor, and a value factor. The Fama and French three-factor model is estimated through the following regression model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i MKT_{rf,t} + \gamma_i SMB_t + \delta_i HML_t + \varepsilon_{i,t} \quad (2)$$

where SMB_t is the return difference between small and large stocks during period t , HML_t is the return difference between stocks with high book-to-market ratio and stocks with small book-to-market ratio during period t , and $\varepsilon_{i,t}$ is a zero-mean error term for asset i during the period t .

As in the case of CAPM, the intercepts α_i measure the abnormal performance of an asset, while regression coefficients β_i, γ_i , and δ_i measure the asset's exposure to their respective factor.

Fama and French (1996) acknowledge that their model does not capture the momentum phenomenon discussed by Jegadeesh and Titman (1993). Carhart (1997) reports that the three-factor model can be augmented to capture these abnormal returns by the addition of a momentum variable. This variable is the returns difference between a portfolio of firms with good short-term performance and a portfolio of firms with poor short-term performance and is known as the momentum variable (MOM). The new four-factor model is estimated using the following regression model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i MKT_{rf,t} + \gamma_i SMB_t + \delta_i HML_t + \theta_i MOM_t + \varepsilon_{i,t} \quad (3)$$

where MOM_t is the return difference between firms with good short-term performance and firms with poor short-term performance during period t and the regression coefficient θ_i measures the asset's exposure to the momentum variable.

Fama and French (2014) further expanded their 1993 model by introducing two new explanatory variables. The first is a profitability variable, which is the difference in returns between a portfolio of firms with robust profitability and a portfolio of firms with weak profitability. This variable is known as robust minus weak (RMW). The second variable is an investment variable, which is the returns difference between a portfolio of firms with conservative investments and a firm with aggressive investments. This variable is known as conservative minus aggressive (CMA). Augmenting equation (3) with these two factor yields a six-factor model. This six-factor model is estimated using the following regression model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i MKT_{rf,t} + \gamma_i SMB_t + \delta_i HML_t + \theta_i MOM_t + \mu_i CMA_t + \rho_i RMW_t + \varepsilon_{i,t} \quad (4)$$

where RMW_t is the returns difference between a portfolio of firms with robust profitability and a portfolio of firms with weak profitability during period t , and CMA_t is the returns difference between a portfolio of firms with conservative investments and a firm with aggressive investments, and the regression coefficients μ_i and ρ_i measures an asset's exposure to their respective explanatory variable.

4.2. Choice of comparables

Which sector portfolios are the best comparables for sin stocks is decided based on the following criteria: firstly, the returns of the sector must be strongly correlated with the returns of the sin stock portfolios. Moreover, the relationship between the returns of comparables and of sin stocks must remain stable over time. Therefore, the following regression is carried out to investigate the evolution of this relationship over time:

$$r_{sin,t} - r_{comp,t} = \lambda_0 + \lambda_1 DATE_t + \varepsilon_t \quad (5)$$

where $r_{sin,t} - r_{comp,t}$ is the difference in returns between the sin portfolio and the comparable portfolio, λ_0 is the intercept, λ_1 is the coefficient for the time variable $DATE_t$, and ε_t is a zero-mean error term.

The comparable portfolios are selected based on which sectors exhibits the highest correlation with the sin stock sectors alcohol, tobacco, and gambling. Following this, a time series regression is carried out using equation (3). If the λ_1 coefficient is found to be statistically different from zero, indicating that the returns difference varies with time, the tested sector is discarded and the sector with second-highest correlation is tested for suitability instead.

5. Empirical Results

5.1. Factor Regressions

5.1.1. Factor analysis

The CAPM is the first model used to test the performance of the sin portfolio, SINDEXT and the performance of each sub-indices, ALCOHOL, TOBACCO and GAMBLING, over the period 1985 to 2018. Three additional performance models are considered by augmenting the CAPM model with size, value, and momentum factors. The CAPM augmented with a size and value factor is referred to as the Fama-French three factor model. The three-factor model with a momentum factor added is referred to as the Fama-French-Carhart four factor model. The results for the regressions are presented in full in Table 4.

Under the CAPM model, SINDEXT generates a risk-adjusted abnormal return of 140 basis points per month, significant at the 1 percent level. The market beta for SINDEXT is 0.42 suggesting lower systematic risk compared to the market portfolio. These findings are consistent with what previous literature has found during earlier time periods on the US market (Salaber, 2009; Liston & Soydemir, 2010; Richey, 2017).

We also investigate the performance of the sub-indices to check if they each exhibit abnormal returns. ALCOHOL, GAMBLING and TOBACCO all generate positive monthly alphas significant at the 1 per cent level. The alphas are similar in magnitude to the SINDEXT portfolio as a whole, with GAMBLING yielding the highest alpha and TOBACCO yielding the lowest. Similarly, the market betas for the three sub-indices are close in magnitude to the market beta of SINDEXT, with GAMBLING having the highest and ALCOHOL having the lowest.

When the model is augmented with a size factor (SMB), the results for SINDEXT remain qualitatively the same. The loading on the SMB factor is negative and small in magnitude. Moreover, the coefficient for SMB is not significant at conventional levels. Once the model is further augmented with a value (HML) factor, i.e. the Fama-French three factor model, the results still remain qualitatively similar. The loadings on both the size and the value factor are negative and small in magnitude, while alpha and market beta remain

close to the values under the CAPM regression. Moreover, the adjusted R^2 -value decreases under the three-factor model, in comparison to CAPM. This suggests that the augmented model does not capture the return variation in the sample data in a significantly better way than CAPM. The sub-indices exhibit similar behavior to SINDEX as a whole once the CAPM is augmented with a size and value factor.

When we expand the model with a momentum factor, alpha decreases but remains statistically significant. The adjusted R^2 -value increases significantly under the four-factor framework indicating that it has stronger explanatory power for the sample data. This can in part be explained by the negative loading on the momentum factor which is statistically significant at the 1 per cent level. The loadings on both the size and value factor are insignificant at conventional levels. The market beta for SINDEX increases to 0.93, exhibiting similar systematic risk to the market as a whole.

The sub-indices also show changes under the four-factor framework. ALCOHOL no longer yields a statistically significant alpha. Previous literature has also found that a portfolio of alcohol stocks does not yield significant alphas under the four-factor model on the US market (Richey, 2014; 2017). On the other hand, both GAMBLING and TOBACCO continue yielding statistically significant alphas at the 1 per cent level. The market betas of all the sub-indices increases but only GAMBLING shows a market beta above 1.

Throughout this analysis, the value factor (HML) has exhibited little-to-no explanatory power. This is in line with discussion of the value factor provided by Fama and French (2017) and Barillas and Shanken (2018). They report evidence that certain combinations of SMB, HML, and MOM possess less explanatory power after the year 2000.

In sum, our results are consistent in showing sin-stock outperformance of the market. SINDEX shows positive abnormal returns statistically significant at the 1 per cent level under both the CAPM and four-factor frameworks. With respect to the sub-indices, TOBACCO and GAMBLING yield positive and statistically significant abnormal returns under both the CAPM and four-factor models. On the other hand, ALCOHOL although yielding a positive and statistically significant alpha under the CAPM and three-factor model, yields no statistically significant alpha once the momentum factor is added.

Table 4 – Return performance of sin stocks on the US market during 1985-2018. The table reports the regression coefficients obtained from time-series regression (Fama-French-Carhart) for equal-weighted portfolios made up of alcohol stocks (ALCOHOL), tobacco stocks (TOBACCO), and gambling stocks (GAMBLING), as well as an equal-weighted portfolio which is constructed by combining the three individual sin portfolios. The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	Alpha (%)	MKT-RF	SMB	HML	MOM	No. of obs.	Adjusted R ²
SINDEX	1.40* (0.27)	0.42* (0.06)				401	0.107
SINDEX	1.40* (0.27)	0.42* (0.06)	-0.02 (0.09)			401	0.105
SINDEX	1.42* (0.27)	0.42* (0.06)	-0.04 (0.09)	-0.08 (0.10)		401	0.104
SINDEX	1.17* (0.35)	0.93* (0.09)	0.21 (0.08)	0.25 (0.16)	-0.35* (0.10)	401	0.518
ALCOHOL	1.41* (0.32)	0.39* (0.07)				401	0.066
ALCOHOL	1.41* (0.32)	0.40* (0.07)	-0.03 (0.11)			401	0.063
ALCOHOL	1.44* (0.32)	0.38* (0.10)	-0.05 (0.11)	-0.05 (0.11)		401	0.063
ALCOHOL	0.44 (0.50)	0.74* (0.12)	0.06 (0.14)	0.21 (0.22)	-0.15 (0.14)	401	0.231
GAMBLING	1.46* (0.44)	0.45* (0.10)				401	0.048
GAMBLING	1.46* (0.44)	0.44* (0.10)	0.09 (0.14)			401	0.046
GAMBLING	1.49* (0.44)	0.43* (0.10)	0.06 (0.15)	-0.11 (0.16)		401	0.044
GAMBLING	1.70* (0.55)	1.28* (0.14)	0.70* (0.15)	0.45*** (0.25)	-0.7* (0.15)	401	0.493
TOBACCO	1.34* (0.30)	0.42* (0.07)				401	0.087
TOBACCO	1.33* (0.30)	0.44* (0.07)	-0.13 (0.10)			401	0.089
TOBACCO	1.34* (0.30)	0.44* (0.07)	-0.14 (0.09)	-0.01 (0.11)		401	0.086
TOBACCO	1.37** (0.60)	0.78* (0.15)	-0.14 (0.17)	0.12 (0.27)	-0.19 (0.17)	401	0.196

5.1.2. Removing Tobacco

The abnormal returns of sin stocks could be driven by the high litigation risk associated with tobacco stocks, as discussed by Hong and Kacperczyk (2009). In order to test whether the regression results are robust to the exclusion of TOBACCO, the CAPM and multifactor-factor regressions are run for a sin portfolio excluding tobacco stocks. The results are presented in Table 5.

The four-factor model yields an alpha of 107 basis points per month when excluding tobacco stocks which is statistically significant at the 1 per cent level. This indicates our results are robust to the exclusion of tobacco stocks. This shows that the increased litigation risk among tobacco firms is not the sole factor causing the abnormal returns.

Table 5 – Return performance of sin stocks on the US market during 1985-2018. The table reports the regression coefficients obtained from time-series regression (Fama-French-Carhart) for equal-weighted portfolios made up of alcohol stocks and gambling stocks but featuring no tobacco stocks. The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, and MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	Alpha (%)	MKT-RF	SMB	HML	MOM	No. of obs.	Adjusted R ²
SIN without TOBACCO	1.44* (0.33)	0.42* (0.07)				401	0.072
SIN without TOBACCO	1.44* (0.33)	0.42* (0.08)	0.03 (0.10)			401	0.069
SIN without TOBACCO	1.47* (0.33)	0.41* (0.09)	0.01 (0.11)	-0.11 (0.12)		401	0.069
SIN without TOBACCO	1.07* (0.38)	1.01* (0.09)	0.33* (0.11)	0.33*** (0.17)	-0.43* (0.11)	401	0.531

5.2. Is the sin stock anomaly resolved?

Richey (2017) and Blitz and Fabozzi (2017) found that the abnormal returns of sin stocks vanish entirely when controlling not only for size, value, and momentum factors but also for exposures to two new Fama-French quality factors – profitability and investment. We thus investigate whether our results are robust to the addition of these two factors. The Carhart four-factor model is augmented with Fama-French profitability and investment factors giving a six-factor framework.

5.2.1. Six-factor regression

First, we run a six-factor regression for a sin portfolio consisting of alcohol, gambling and tobacco stocks for the time period 1985-2018. The results for this regression are presented in Table 6.

Under the six-factor framework, SININDEX yields a monthly alpha of 124 basis points which is statistically significant at the 1 per cent level. Moreover, we get significant loading on both the SMB and on the RMW factors, but not on the HML factor. This is in line with results presented by Fama and French (2017), who note that the HML factor may be superfluous when also accounting for the SMB and RMW factors.

Our results indicate that controlling for profitability and investment is not sufficient for explaining the sin stock over-performance phenomenon in the US market for the period 1985-2018. This is in contrast to the results presented by Richey (2017) and Blitz and Fabozzi (2017), who report no significant alpha when controlling for profitability and investment.

Table 6 – Return performance of sin stocks under a six factor model on the US market during 1985-2018. The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance, RMW is the return difference between stocks with robust profitability and stocks with weak profitability, and CMA is the return difference between stocks with conservative investment and stocks with aggressive investment. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	Alpha (%)	MKT-RF	SMB	HML	MOM	CMA	RMW	No. of obs.	Adjusted R ²
SININDEX	1.24* (0.27)	0.48* (0.07)	0.13* (0.10)	-0.23 (0.13)	-0.08 (0.44)	0.13 (0.18)	0.49* (0.13)	401	0.013

5.2.2. Six-factor regression including defense stocks

A possible reason for the discrepancy between our results and the papers by Richey (2017) and Blitz and Fabozzi (2017) is that they both use a more expansive definition of sin stocks. Richey (2017) includes defense and adult entertainment stocks in his sin portfolio whereas Blitz and Fabozzi (2017) include defense stocks in their sin portfolio. Our choice to limit our definition of sin stocks to the classical sin triumvirate may allow

for a more direct observation of the shunning effect, since there could be investors willing to hold, for example, defense but not alcohol, tobacco, and gambling.

To check if our results are robust to the addition of defense stocks, we construct an equally weighted portfolio consisting of alcohol, gambling, tobacco and defense stocks. Adult entertainment stocks are not included due to data availability reasons (see section 3.1). A regression for this sin portfolio is then run for the time period 1985-2018 using this six-factor framework. The results are presented in Table 7.

Even with the addition of defense stocks, a sin portfolio consisting of alcohol, gambling, tobacco and defense stocks generates a positive monthly alpha of 98 basis points. This result is statistically significant at the 1 per cent level. Furthermore, running a regression on an equal-weighted portfolio consisting solely of defense stocks also yields positive alpha. This result also benefits from significance at the 1 per cent level. This indicates that it is not our choice to exclude defense stocks which causes the discrepancy between our results and those of Richey (2017) and Blitz and Fabozzi (2017).

Another potential reason for the discrepancy is in the use of weighting method in our portfolio construction. Our portfolios are constructed using equal weighting, whereas Richey (2017) uses price weighting and Blitz and Fabozzi (2017) uses value weighting. Plyakha, Uppal, and Vilkov (2011) present evidence that using equal-weighted portfolios causes higher alpha when doing Fama-French style asset pricing regressions. The higher alphas stem from the frequent rebalancing to keep the portfolios equally weighted. This could be a significant factor in why our results yield significant abnormal returns whereas those presented by Richey (2017) and Blitz and Fabozzi (2017) do not. Our choice of an equally weighted portfolio was made because nearly all previously literature has constructed such portfolios (see Table 1).

Table 7 – Return performance of sin stocks, including defense stocks, under a six factor model on the US market during 1985-2018. SININDEX is an equal-weighted portfolio consisting of alcohol, tobacco, and gambling stocks. DEFENSE is an equal-weighted portfolio consisting of defense stocks. The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance, RMW is the return difference between stocks with robust profitability and stocks with weak profitability, and CMA is the return difference between stocks with conservative investment and stocks with aggressive investment. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	Alpha (%)	MKT-RF	SMB	HML	MOM	CMA	RMW	No. of obs.	Adjusted R ²
SININDEX + DEFENSE	0.98* (0.26)	0.46* (0.07)	0.17*** (0.09)	-0.21*** (0.13)	-0.09 (0.06)	0.05 (0.18)	0.45* (0.13)	401	0.15
DEFENSE	1.00* (0.33)	0.41* (0.08)	0.28** (0.12)	-0.12 (0.16)	-0.11 (0.07)	-0.21 (0.22)	0.31** (0.16)	401	0.013

5.3. Variation with time regressions

To investigate whether the sin-phenomenon is still present during more modern times, similar regressions to those in section 5.1.1 are run for separate time periods. The time periods for which the regressions are run are 1985-1995, 1996-2006 and 2007-2018. The results for the three periods are presented in Table 8.

When running the Fama-French-Carhart regression over the three-time chunks, it is made evident that alpha is increasing with time. The value for alpha in the first time period is 101 basis points, followed by 145 basis points in the second, and, finally, 159 basis points in the final time period. All these values benefit from statistical significance at the 1 percent level. Moreover, the opposite trend is present for the loading on the explanatory variables included in the regression: their loadings tend to decrease over time. This is also the case for the Adjusted R² values for the regression, which exhibit a substantial decrease over time. The results remain qualitatively the same when varying which time period is ten and a half rather than ten years long.

Table 8 – Variation of sin stock performance over time on the US market. The table reports the regression coefficients obtained from three time-series regressions (Fama-French-Carhart) for equal-weighted portfolios made up of alcohol stocks, gambling stocks, and tobacco stocks. The three regressions are carried out over separate time frames (1985-1995, 1996-2006, and 2007-2018). The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	SINDEX (1985–1995)	SINDEX (1996–2006)	SINDEX (2007–2018)
Alpha (%)	1.01* (0.25)	1.45* (0.40)	1.59* (0.35)
MKT	1.00* (0.06)	0.29* (0.09)	0.11 (0.08)
SMB	0.38* (0.10)	0.19*** (0.11)	-0.06 (0.11)
HML	0.03 (0.12)	0.20 (0.12)	-0.10 (0.44)
MOM	-0.07 (0.09)	-0.13*** (0.07)	-0.06 (0.11)
No. of obs.	120	120	126
Adjusted R ²	0.73	0.10	0.01

The results show that the abnormal returns of sin stocks are increasing over time. This can possibly be explained by norm-following investors increasingly choose to shun sin stocks. 26 per cent of professionally managed assets are screened using ESG criteria, up from 11 per cent in 2011. More than 70 per cent of such funds refrain from investing in the sin triumvirate (Statman, 2000). More generally, an increased focus on SRI may be reflecting changing societal values that are more opposed to sinful activities. Stocks that are shunned are found to be cheaper relative to their comparables by Merton (1987). The price of shunned stocks is lowered relative to their fundamental values since a segment of investors are unwilling to invest in them. Therefore, if more investors are unwilling to invest in sin stocks, their prices would be further depressed and their return expectations would increase.

The neglect of stocks also leads to limited risk sharing and under such conditions CAPM no longer holds, which means that systematic risk is not the only relevant factor for pricing (Merton, 1987). This implies, as argued by Hong and Kacperczyk (2009), that for sin stocks other risk factors such as litigation risk are also relevant for pricing. This factor should also lead to higher required return for stocks that are shunned. If litigation risk and legislative pressure has increased over time it is entirely plausible that the degree of sin-stock underpricing is increasing. This, according to Merton (1987), should lead to increasing over-performance for sin stocks.

However, it is not necessarily the increased neglect of sin stocks that is driving the rising abnormal returns. Another potential explanation is that the explanatory power of the variables included in the regression are decreasing with time. Barillas and Shanken (2018) found that the explanatory power of a combination of value, size, and momentum factors declined substantially after the year 2000. This corroborates well with our findings, where the loading on these explanatory variables decreased with time.

Due to data availability, this analysis cannot be carried out further back than 1985 when including gambling. However, by excluding gambling from SININDEX, the same method was applied to data going back to 1963 to check if our results are robust over a longer time period. The results for this analysis are presented in Table 9.

The same trend is visible over the period 1963-2018. Alpha increases with time, indicating that the sin stock phenomenon may be more pronounced today than it was during previous time periods. However, the adjusted R^2 -values are decreasing with time, as are the loadings on the explanatory variables. This corroborates well with the results presented by Barillas and Shanken (2018). As was the case with the shorter analysis, the results remain qualitatively the same when varying which time chunks are longer than the others.

Table 9 - Variation of sin stock performance over time on the US market. The table reports the regression coefficients obtained from five time-series regressions (Fama-French-Carhart) for equal-weighted portfolios made up of alcohol stocks, gambling stocks, and tobacco stocks. The three regressions are carried out over separate time frames (1963-1974, 1975-1985, 1986-1996, 1997-2006, and 2007-2018). The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance. The data for the explanatory variables is retrieved from K. French's data library. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	SINDEX (1963–1974)	SINDEX (1975–1985)	SINDEX (1986–1996)	SINDEX (1997–2006)	SINDEX (2007–2018)
Alpha (%)	0.42* (0.40)	0.92* (0.25)	1.02* (0.27)	1.31* (0.40)	1.70* (0.40)
MKT	1.21* (0.15)	0.85* (0.06)	0.91* (0.07)	0.31* (0.10)	0.04 (0.11)
SMB	0.28 (0.20)	0.51* (0.08)	0.12* (0.11)	0.1 (0.12)	-0.15 (0.16)
HML	0.15 (0.25)	0.39* (0.09)	0.07* (0.12)	0.22 (0.13)	-0.07 (0.16)
MOM	0.08 (0.17)	-0.15** (0.06)	0.12* (0.09)	-0.04 (0.13)	-0.05 (0.09)
Adjusted R ²	0.36	0.72	0.59	0.05	0.01

5.4. Long-short portfolio

As a robustness test, we construct a portfolio that is long sin stocks and short comparable stocks. The comparable portfolio consists of stocks that are similar to the selected sin stocks without being considered vices. As such, a long-short portfolio could explain abnormal returns which are not captured by the explanatory variables used in this paper. If abnormal returns are present for the long-short portfolio, it could indicate that the sinful nature of alcohol, gambling and tobacco is what is driving the over-performance.

5.4.1. Choice of comparables

The choice of comparable industries was made on the basis of strongest correlation with the sin industries. An equal-weighted portfolio of SODA and FOOD were found to be the best comparable for ALCOHOL, HOTELS was found to be the best comparable for GAMBLING, and FUN was found to be the best comparable for TOBACCO. This corresponds well to the comparable industries used by Hong and Kacperczyk (2009). The

correlation of the comparable industries with their respective sin sectors are presented in Table 10.

Table 10 – Correlations found between industry returns. The table presents the correlations between the time-series returns for the sin sectors used in this work, and the comparable industries which yielded the highest correlation with their respective sin industry.

INDEX	SODA + HOTELS	FOOD	FUN
ALCOHOL	0.603		
TOBACCO		0.487	
FUN			0.573

Moreover, the difference in returns between the sin industries and their comparables must not be statistically significant and any return difference must not vary significantly over time, see section 4.2. The λ_0 -coefficients are not found to be statistically significant for any of the sin-comparable pairs. Likewise, the λ_1 -coefficients are not found to be statistically significant for any of the sin-comparable pairs. Consequently, the choice of comparables can be said to be suitable. The results of the return-difference regressions are presented in Table 11.

Table 11 – Return differences between sin stock portfolios and their comparables. The table presents the results of a time-series regression investigating if the differences in time-series returns between equal-weighted sin stock sector portfolios and their equal-weighted comparable sector portfolios varies with time. λ_0 is a constant (intercept) and λ_1 is the coefficient for a date variable.

PORTFOLIO	λ_0	λ_1	No. of obs.	Adjusted R ²
DIFF (ALCOHOL – SODA & HOTELS)	-0.070315 (1.089965)	0.000035 (0.000088)	401	0.0021
DIFF (TOBACCO – FOOD)	0.353938 (1.375286)	-0.000020 (0.000112)	401	0.0024
DIFF (GAMBLING – FUN)	0.932456 (1.253635)	0.000024 (0.000102)	401	0.0024

5.4.2. Comparables study

First the CAPM is used to test the performance of a portfolio which is long a sin portfolio, SININDEX, and short a comparable portfolio, COMPDEX. The Fama-French three factor model is also considered which is the CAPM augmented with a size and value factor. Finally, the Fama-French-Carhart four factor model which includes a momentum factor

is used to test the performance of the long-short portfolio. The results for the long-short portfolios are presented in full in Table 12.

For the basic CAPM regression, the portfolio yields a monthly alpha of 75 basis points, significant at the 1 per cent level. The market beta is close to zero (-0.03 per cent), but the p-value for the market beta indicates that it is not significant at conventional levels.

For the three-factor model the portfolio which is long SINDEXT and short COMPTDEX yields a monthly alpha of 75 basis points. This result is also significant at the 1 per cent level. The market beta is close to zero (-0.003 per cent), and the p-values for both the SMB and HML factors indicates that they have poor explanatory power.

When controlling for all the factors in the four-factor Fama-French-Carhart model, the portfolio which is long SINDEXT and short COMPTDEX results in a monthly alpha of 107 basis points. This result is significant at the 1 per cent level. As in the case with the three-factor model, the market beta is very close to zero for this portfolio (-0.08 per cent monthly). However, the P-values for SMB, MOM, and HML indicate that these factors have poor explanatory power for the regression.

Table 12 – Return performance of sin stocks in excess of their comparables on the US market during 1985-2018. The table reports the regression coefficients obtained from time-series regression (Fama-French-Carhart) for equal-weighted portfolios made up of alcohol stocks (ALCOHOL), tobacco stocks (TOBACCO) and gambling stocks (GAMBLING). The return of the market portfolio is from the market portfolio constructed by K. French and the risk-free rate is taken to be the yield of a one-month US treasury bill. MKT-RF is the returns of the market portfolio sans the risk-free rate, SMB is the return difference between small and large stocks, HML is the return difference between stocks with high market-to-book ratios and stocks with low market-to-book ratios, MOM is the return difference between stocks with good short-term performance and stocks with poor short-term performance. The symbols *, **, and *** denotes significance at the 1 %, 5 %, and 10 % level, respectively. The values presented within parenthesis are the standard errors for the regression coefficients.

INDEX	Alpha (%)	MKT	SMB	HML	MOM	No. of obs.	Adjusted R ²
SINDEX - COMPDEX	0.75* (0.18)	-0.03* (0.04)				401	0.000
SINDEX - COMPDEX	0.74* (0.18)	-0.00* (0.04)	-0.21* (0.05)			401	0.028
SINDEX - COMPDEX	0.73* (0.18)	0.00* (0.04)	-0.20 (0.06)	-0.04 (0.06)		401	0.026
SINDEX - COMPDEX	1.07* (0.36)	-0.08* (0.09)	-0.36 (0.10)	-0.22 (0.17)	-0.06 (0.10)	401	0.026
ALCOHOL - COMPDEX	0.76* (0.26)	-0.06* (0.06)				401	0.000
ALCOHOL - COMPDEX	0.74* (0.26)	-0.03* (0.06)	-0.21** (0.09)			401	0.012
ALCOHOL - COMPDEX	0.74* (0.26)	-0.03* (0.06)	-0.21** (0.09)	0.00 (0.10)		401	0.001
ALCOHOL - COMPDEX	0.68 (0.27)	-0.01* (0.06)	-0.21** (0.09)	0.03 (0.10)	0.08 (0.06)	401	0.011
GAMBLING - COMPDEX	0.80* (0.32)	0.00* (0.07)				401	0.002
GAMBLING - COMPDEX	0.80* (0.32)	0.01* (0.07)	-0.09 (0.10)			401	0.003
GAMBLING - COMPDEX	0.80* (0.32)	0.01* (0.08)	-0.09 (0.11)	-0.00 (0.12)		401	0.006
GAMBLING - COMPDEX	0.89* (0.32)	-0.02 (0.08)	-0.08 (0.11)	-0.04 (0.12)	-0.12*** (0.07)	401	0.000
TOBACCO - COMPDEX	0.68* (0.31)	-0.04* (0.07)				401	0.001
TOBACCO - COMPDEX	0.67* (0.30)	0.01* (0.07)	-0.31* (0.01)			401	0.020
TOBACCO - COMPDEX	0.64* (0.31)	0.02* (0.07)	-0.29* (0.10)	0.10 (0.12)		401	0.019
TOBACCO - COMPDEX	0.55* (0.31)	0.05* (0.07)	-0.30 (0.10)	0.14 (0.11)	0.12*** (0.07)	401	0.024

In summary, the results show consistently that sin stocks outperform the chosen comparables. SINDEX-COMPDEX generates positive monthly alphas statistically significant at the 1 per cent level under all frameworks. This is consistent with results presented by Hong and Kacperczyk (2009) who look at sin-stock outperformance for US stocks over the period 1926-2006 and who use similar comparables to us. They however find monthly alphas between 25 and 30 basis points under the CAPM and multifactor frameworks. The alphas generated using our data yield monthly alphas between 117 and 140 basis points. This discrepancy could be caused by us using a shorter and more recent time period (1985-2018). As demonstrated in section 5.3, the abnormal returns from sin stocks are higher in later time periods.

5.5. Robustness tests

The robustness of the results are investigated using the Breusch-Pagan, Durbin-Watson and Variance inflation tests to check for heteroscedasticity, autocorrelation, and multicollinearity, respectively. In Table 13, the variance inflation scores are presented for the Fama-French three-factor SINDEX analysis, see section 5.1.1. These values indicate that multicollinearity is not an issue for this regression model. The other regressions presented in this report yield similar, and often lower, VIF-values, but these are not presented for the sake of brevity.

Table 13 – Results of variance inflation test for multicollinearity. The table presents the variance inflation factors for the explanatory variables used in the three-factor regression.

Variable	VIF
MKT_RF	1.39
SMB	1.48
HML	2.33
MOM	1.45

The Breusch-Pagan test for the Fama-French three factor analysis yields a Breusch-Pagan test statistic of 4.360, which indicates that heteroscedasticity is not a significant issue for the regression model. The other regressions yield similar results, and heteroscedasticity is not found to be a significant issue for any of the regressions presented in this work.

The Durbin-Watson test for the Fama-French three factor analysis yields a Durbin-Watson test statistic of 1.957. This indicates autocorrelation of the error term is not a significant issue for the regression model. Again, all the other regressions presented in this work yield similar values for the Durbin-Watson test statistic, and autocorrelation can thus be said to not be an issue.

In summary, the results of the robustness tests carried out indicate that heteroscedasticity, autocorrelation, and multicollinearity are not impacting our analysis in any statistically significant way.

6. Conclusion

This paper has provided evidence that the phenomenon of sin stocks yielding abnormal returns persists until the present day. In addition, the magnitude of the abnormal returns associated with sin stocks is found to be increasing over time. Furthermore, our paper investigates the recent results of Blitz and Fabozzi (2017) and Richey (2017) which show that the abnormal returns shown of sin stocks dissipates when controlling for Fama and French's two quality factors – profitability and investment. Our results show that sin stock over-performance endures when accounting for these two quality factors.

There are several implications to our results. Firstly, we provide evidence that the sin stock over-performance phenomenon has not been resolved as claimed by Blitz and Fabozzi (2017) and further research is needed to explain it. Secondly, we show that it continues to be worthwhile for investors to invest in sin stocks as they may enjoy significant abnormal returns to their investments.

As mentioned above we find that sin stock over-performance is increasing over time. We hypothesize that the increase in abnormal returns is because investors are increasingly integrating social considerations into their investment decisions and thus shunning sin stocks (Merton, 1987). However, we have no direct evidence of what is driving the increasing over-performance. A plausible alternative explanation is that certain combinations of Fama-French factors are losing their explanatory power over time (Barillas & Shanken, 2018). Therefore, a suggestion for future research is investigations into whether a shunning effect and/or weakening of explanatory variables are contributing to the increasing abnormal returns of sin stocks. A potential venue for such research is investigating whether shares of sin stocks are being decreasingly held by large institutional investors such as pension funds, banks and insurance companies.

Another possible future research topic is an investigation into whether sin firms are increasingly being financed by debt or not. Hong and Kacperczyk (2009) find that sin firms use debt financing more than expected when accounting for predictors for capital structure. They hypothesize that equity underpricing due to shunning is what is causing sin firms to use relatively more debt to finance themselves. If an increasing shunning

effect is what is driving increasing abnormal returns among sin stocks, the abnormal use of debt financing should also be increasing with time.

7. References

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