GUILTY PROFITS: DOES THE MARKET REWARD THE UNETHICAL?

EVIDENCE FROM THE U.S. STOCK MARKET ON SIN STOCK PERFORMANCE BETWEEN 1965-2023

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Abstract:

This paper examines the performance of U.S. sin stocks – alcohol, tobacco and gambling – over the period 1965-2023, focusing on risk-adjusted abnormal returns. Using time-series regression across the CAPM, Fama-French Three-Factor model, Carhart Four-Factor model, and Fama-French Five-Factor model we find that sin stocks generate significant abnormal returns, with a monthly alpha of 42 basis points under the Fama-French Five-Factor model. Industry-level analysis finds that while all sin industries exhibit positive abnormal returns over the full period, only alcohol stocks maintain significance during 2007-2023, a time marked by heightened ESG adoption. However, findings from a placebo test suggest that the sin stock classification and its associated premium is influenced by random noise. This challenges the robustness of the sin premium and its attribution to systematic factors or social norms.

Keywords:

Sin stocks, Abnormal returns, Exclusionary screening

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1. Introduction

One of the most widely adopted and growing sustainable investing practices is exclusionary screening (GSIA 2018, 2022). Exclusionary screening involves the exclusion of certain assets from the universe of investments, usually the most socially controversial assets, such as alcohol, tobacco and gambling who collectively are known as "sin stocks". Merton (1987) proposed that neglected stocks carry a premium as compensation for reduced liquidity, higher transaction costs and limited risk sharing. This concept suggests that when stocks, such as sin stocks, are excluded from portfolios they may deliver higher expected returns, resulting from a smaller investor base. Empirical studies on sin stock performance support this notion, suggesting that sin stocks experience higher returns than the market or their comparable stocks (Salaber 2007, 2008; Fabozzi, Ma and Oliphant 2008; Hong and Kacperczyk 2009; Statman and Glushkov 2009; Liston and Soydemir 2010). These studies found that sin stocks exhibit positive significant alphas in the U.S., European and global markets under the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor model (FF3) and the Carhart Four-Factor model (Carhart). The mechanism driving the higher expected returns of sin stocks has been attributed to neglect by norm-constrained investors and heightened litigation risk amplified by social norms (Hong and Kacperczyk 2009). Similar to Merton (1987), Hong and Kacperczyk (2009) suggest that the avoidance of sin stocks by an important set of investors, particularly institutional investors, leads to depressed stock prices relative to their fundamental values due to limited risk sharing. Consequently, sin stocks should yield higher expected returns as compensation. However, the literature presents conflicting findings regarding the persistence of the "sin premium". While earlier studies have demonstrated that sin stocks generate positive abnormal returns, more recent studies have shown that this overperformance can be explained by the Fama and French (2015) quality factors profitability and investment (Richey 2017; Blitz and Fabozzi 2017; Sagbakken and Zhang 2022). These studies find that under the Fama-French Five-Factor model (FF5) the significant positive alpha for sin stocks disappears. However, Zerbib (2022) shows that exclusionary screening significantly affects asset returns, and the impact of sustainable investors on a company's cost of capital can be substantial in many cases.

In this paper, we investigate whether U.S. sin stocks in the alcohol, tobacco and gambling industries, known as the "triumvirate of sin", deliver positive abnormal returns from 1965 to 2023 on a risk-adjusted basis. The most cited work on sin stocks up to date by Hong and Kacperczyk (2009) covers the period 1965-2006. We continue where their study ends and provide a time segmented analysis of the period 2007-2023. The trend of sustainable investing during this period, with exclusionary screening as a widely adopted strategy, motivates an up-to-date examination of sin stock returns. Investigating this will contribute further knowledge of the tradeoff between sustainable investment practices and financial gains. Moreover, we identify inconsistencies in methodologies across studies that present opposing conclusions about sin stock returns. By synthesizing elements from different studies and employing a comprehensive methodological approach we aim to address these inconsistencies and provide a robust assessment of the returns of sin stocks.

We test our predictions by performing time-series regression on the monthly returns of sin stocks for the CAPM, FF3, Carhart and FF5 models. First, we find that a value weighted portfolio comprised of the monthly returns of U.S. alcohol, tobacco and gambling stocks, net of the risk-free rate, show abnormal returns over 1965-2023. This finding is robust across all models and

contradicts others who find the abnormal returns of sin stocks to disappear when accounting for the Fama-French quality factors profitability and investment (Richey 2017; Blitz and Fabozzi 2017; Sagbakken and Zhang 2022). Our results show a positive alpha of 42 basis points (bps) significant at the 1% level. Second, we run time-series regressions for the time-periods 1965-1985, 1986-2006 and 2007-2023, all else equal. We find that in the period 2007-2023, alpha remains positive and significant. For the FF5 model the alpha is estimated to 47 bps, significant at the 5% level. Third, we segment our portfolio by industry, all else equal, and find that each of the sin industries generate positive and significant alphas over the period 1965-2023 across all factor models. However, over the period 2007-2023 we find that only the alcohol portfolio delivers a significant alpha under the FF5 model. The tobacco and gambling portfolios' alpha remain positive but insignificant in the FF5 model. Finally, we change the setting of the dependent variable, consistent with Hong and Kacperczyk (2009) we find that an equal weighted portfolio long on sin stocks and short their comparable stocks have a positive significant alpha over the period 1965-2023. This finding is robust in the FF5 model. The long-short portfolios' alpha is estimated to 21 bps, significant at the 10% level. However, the results from a placebo test suggest that the observed outperformance of sin stocks relative to their comparables may be driven by random noise, raising questions about the robustness of these findings.

Our findings come with several implications. They oppose the findings of studies who find that the abnormal returns of sin stocks disappear when accounting for the Fama-French quality factors profitability and investment (Richey 2017; Blitz and Fabozzi 2017; Sagbakken and Zhang 2022). Moreover, our results show that there may exist a tradeoff between Environmental, Social and Governance (ESG) goals and financial returns as we show that sin stocks generate abnormal returns of 47 bps monthly or 5.64% annually between 2007-2023. This could potentially be explained by the fact that exclusionary screening significantly affects asset prices (Zerbib 2022). However, our study cannot tell whether the observed abnormal returns are due to the neglect effect (Merton 1987), or systematic exclusion of these stocks driven by social norms (Hong and Kacperczyk 2009). In addition, our results are limited to the U.S. and traditional sin stocks, specifically the triumvirate of sin.

Our paper contributes to the body of research on sustainable investing practices and their impact on asset pricing. Within that literature, our work is most closely related to studies examining the returns of excluded assets, or sin stocks. There are several papers covering the topic of sin stock returns, but the closest papers to our research are Hong and Kacperczyk (2009), Richey (2017), Blitz and Fabozzi (2017) and Sagbakken and Zhang (2022). Each examines the returns of sin stocks but with notable methodological differences. Hong and Kacperczyk (2009) studied U.S. sin stocks in the alcohol, tobacco and gambling industries (the triumvirate of sin) over 1965-2006. The authors employ an equal weighted approach and use the monthly returns of sin stocks minus the monthly returns of comparable stocks as the dependent variable in their regressions. Their analysis includes the CAPM, the Fama-French three-factor model and the Carhart four-factor model. In contrast, Richey (2017) extends the definition of U.S. sin stocks beyond the triumvirate of sin to include payday lenders, adult entertainment and defense stocks. The studied period is 1986-2016 and the Fama-French five-factor model is included in addition to the models applied by Hong and Kacperczyk (2009). Richey (2017) adopts a price weighted approach with daily sin stock returns less the risk-free rate as the dependent variable. Blitz and Fabozzi (2017) examine sin stocks in the U.S., Europe and Japan. In their U.S sample the authors include alcohol, tobacco and defense stocks over the period 1963-2016. They employ a value-weighted approach and use the monthly sin stock returns over the monthly market return as the dependent

variable. Like Richey (2017) the authors include the FF5 model. Sagbakken and Zhang (2022) focus on the European market from 2007 to 2020, studying both "traditional" sin stocks, alcohol, tobacco, gambling and defense, but also "new" sin stocks, identified as stocks in the coal, oil and gas, metals and mining and uranium industries. They use a value weighted approach and use the monthly returns of sin stocks less the risk-free rate as the dependent variable. Consistent with Richey (2017) and Blitz and Fabozzi (2017) they apply the Fama-French five-factor model in their analysis. In all three studies they conclude that the significant positive alpha for sin stocks become insignificant under the FF5 model, meaning that sin stocks do not generate positive abnormal returns when the profitability and investment factors are included. The methodological differences between the study of Hong and Kacperczyk (2009) and the more recent make direct comparisons challenging. There are disparities in weighting, dependent variables and sin stock sample. Our thesis addresses the methodological differences, and we employ the equal weighted long-short portfolio approach as Hong and Kacperczyk (2009) and a value weighted excess sin portfolio. This enables us to assess whether the abnormal return of sin stocks persists under the FF5 model for different portfolio constructions and make direct comparison with Hong and Kacperczyk (2009). We find that, contrary to the conclusions of Richey (2017), Blitz and Fabozzi (2017) and Sagbakken Zhang (2022) that the abnormal returns of sin stocks do not disappear under the FF5 model over the extended period. This holds true for both the equal weighted long-short portfolio and the value weighted excess sin portfolio. Furthermore, to our knowledge, no prior study has applied a placebo test in this context. Our results challenge the validity of interpreting the sin premium as conclusive evidence of outperformance and highlight the need for further investigation into the methodological challenges of isolating sin stocks' performance. Therefore, a key contribution to the literature from this paper is the placebo test.

The remainder of this paper is structured as follows. Section 2 presents the background on and selection of our sample, the data and portfolio constructions, the variables in the time-series regression and the employed factor models with their respective equations. Section 3 presents the empirical results and discussion. Section 4 shows robustness tests and section 5 concludes.

2. Data and Methodology

In an ideal scenario, we would employ an empirical approach that would establish a causal relationship between the sin stock classification and abnormal returns. This would require a randomized experimental setting that firms are randomly assigned to sin or non-sin categories. Such a design would isolate the effect of the sin stock classification on returns and eliminate the influence of confounding factors. However, this lacks feasibility as firms independently select into the industries they operate in. This non-random assignment introduces a selection bias, meaning that sin stocks may possess observed characteristics influencing their returns independent of their classification of sin stocks. To maintain comparability with previous studies, we adopt the time-series regression approach to investigate the abnormal returns of sin stocks. This approach, while rigorous, has limitations compared to the ideal setting. One concern is potential endogeneity, as our time-series regressions do not control for firm-level characteristics that may confound the relationship between the sin classification and returns. For example, cross-sectional regression methods could address omitted variables by accounting for individual stock attributes. We test different model specifications to see if our results hold and perform tests in the robustness section to further evaluate our setting.

2.1. Background on and selection of sin stocks

This section provides an overview of the rationale and methodology for selecting sin stocks for this study. It is divided into two parts: a discussion of the background on sin stock selection and the process used to construct the sin stock sample.

2.1.1. Background on Sin Stock Selection

The focus on the Triumvirate of sin (alcohol, tobacco and gambling) has been carefully considered for this study for several reasons. First, these industries are widely regarded as sinful due to their addictive properties and the negative social consequences of excess use, a perception reinforced by public health concerns and regulatory frameworks in countries like the U.S. (Salaber 2007; Hong and Kacperczyk 2009). Second, these industries are consistently examined in the sin stock literature, enabling meaningful comparisons with previous research. Third, firms in these industries are always excluded by Socially Responsible Investing (SRI) funds, further supporting their classification as the main sin stocks (Zerbib, 2022). Other studies have expanded the classification of sin stocks to include industries like adult entertainment and defense (Richey 2017; Blitz and Fabozzi 2017). We exclude adult entertainment due to the lack of stock return data availability, as most firms in this industry are privately held. Zerbib (2022) follows Hong and Kacerpczyk (2009) in excluding the defense industry because not all US investors regard it as unethical. While perceived as unethical by some, it also exhibits fundamentally different characteristics from the triumvirate of sin. This is because the defense industry is heavily affected by unpredictable geopolitical events (Baker, Bloom and Davis 2016). In contrast, alcohol, tobacco, and gambling are primarily influenced by consumer demand, regulatory interventions and litigation risk due to being consumer products (Hong and Kacperzcyk 2009). Due to these fundamental differences, we exclude the defense sector from our analysis. While stocks with high environmental footprints, or "brown stocks", are increasingly excluded by investors, they are not considered here. Brown stocks are not consistently defined as sin stocks in established literature, and their diversity across multiple industries makes it challenging to form a comparable set of firms. Therefore, they fall outside the scope of this study.

2.1.2. Construction of Sin Stock Sample

Based on the triumvirate of sin, we identify sin stocks from the universe of stocks in alignment with Hong and Kacperczyk (2009). We begin by classifying sin stocks based on the Fama-French (1997) industry classification, which sorts stocks into 48 industries according to SIC codes. Sin stocks in our study are drawn from industry group 4 (beer or alcohol) and industry group 5 (smoke or tobacco). Specifically, stocks with SIC codes 2080-2085 are categorized as alcohol related, while those with SIC codes 2100-2199 are tobacco related. However, the Fama-French classification does not distinguish gambling stocks from Fama-French (1997) industries Meals and Hotels and Fun. To address this, we supplement our classification with North American Industry Classification (NAICS) codes to identify gambling stocks, which include the following: 7132, 71312, 713210, 71329, 713290, 72112, and 721120.

Our final definition of sin stocks, therefore, includes the Fama-French industry groups 4 and 5, along with the specified NAICS gambling codes. To further refine this list, we extend our search to the business segment level. Using Compustat Segments data which offers operational segmentation data for over 23,000 North American companies from 1976 to 2024, we capture additional information on SIC and NAICS codes for different business segments within each company. Compustat Segments offer several SIC variables (Standard Industry Classification Code, SIC Code (Primary), SIC Code (Secondary)) as well as several NAICS variables (North American Industry Classification Code, Primary Historical NAICS, NAICS Code (Primary), NAICS Code (Secondary)). To find companies that have diversified operations across multiple industries, we use all of these variables to screen for companies involved in our sin stock definition. This is crucial to accurately find sin stocks as many of them are diversified and have multiple businesses. A company is initially classified as a sin stock if any of its business segments falls under the specified SIC codes for alcohol, tobacco or the NAICS codes for gambling. Within this list on Compustat Segments, we identify 384 unique company names, accompanied by 384 unique CUSIP codes, over the period 1976 to 2024. The next step in the process is to search for these companies in The Center for Research in Security Prices (CRSP) database, which contains a comprehensive collection of security price, return, and volume data for the NYSE, AMEX and NASDAQ stock markets from 1925 to 2023. Since Compustat data is only available from 1976, we backfill the list in CRSP from 1976 to 1965, meaning that a company once considered sin, is considered sin throughout its history. The best alternative to transfer the companies from Compustat to CRSP is to use company specific CUSIP codes, but, since CUSIPs differ between Compustat and CRSP for some companies, we complement the CUSIPs with manual search for each Company Name in CRSP. In total, we find 283 unique securities in CRSP, denoted by the PERMNO variable. PERMNO allows tracking of a security through its entire trading history. Next, we manually screen each stock to confirm whether the company has or has had operations in any of the sin industries and then we label them accordingly. A security that we are not able to label as sin is excluded. Through this manual screening process, we filter out 45 securities and classify the remaining 238 as sin, using their PERMNOs. Next, we filter the dataset to only include PERMNOs with a Share Code of 10 or 11 which indicates that the security is an ordinary common share incorporated in the U.S. Excluded share codes are for example certificates, ADRs, SBIs and Units. After this filter, we are left with 188 manually classified SIN stocks that are or have been trading on NYSE, NASDAQ or AMEX. This is our finale sin stock sample.

We have also performed cross-checks with previous research, mainly Hong and Kacperczyk (2009). Considered together, our screening procedure yields an accurate and comprehensive list of stocks in alcohol, tobacco and gambling industries.

Table 1: Yearly Distribution of Sin Stocks by Industry (1965–2023) and Unique Totals.

This table displays the yearly distribution of sin stocks across the Tobacco, Alcohol, and Gambling industries from 1965 to 2023. The counts represent unique stocks classified per year within each industry. The 'Total' column aggregates the number of sin stocks across all industries for each year. The 'Total' row at the bottom represents the unique stock counts over the full period (1965–2023).

Year	Tobacco	Alcohol	Gambling	Total	Year	Tobacco	Alcohol	Gambling	Total
1965	10	9	0	19	1995	13	21	62	96

Year	Tobacco	Alcohol	Gambling	Total	Year	Tobacco	Alcohol	Gambling	Total
1966	10	9	0	19	1996	15	25	62	102
1967	10	10	0	20	1997	16	27	62	105
1968	10	10	0	20	1998	14	27	58	99
1969	10	11	1	22	1999	13	27	52	92
1970	10	11	2	23	2000	11	24	43	78
1971	10	11	2	23	2001	9	22	38	69
1972	11	16	5	32	2002	10	21	38	69
1973	11	18	6	35	2003	10	20	37	67
1974	11	18	6	35	2004	10	20	39	69
1975	11	19	6	36	2005	10	18	39	67
1976	11	19	6	36	2006	10	17	37	64
1977	11	19	6	36	2007	10	16	37	63
1978	11	19	9	39	2008	12	16	34	62
1979	11	19	11	41	2009	11	14	34	59
1980	11	20	11	42	2010	10	14	31	55
1981	10	20	16	46	2011	10	14	30	54
1982	10	19	16	45	2012	10	14	31	55
1983	10	20	17	47	2013	10	15	32	57
1984	10	18	19	47	2014	11	15	30	56
1985	10	19	20	49	2015	11	14	27	52
1986	9	18	21	48	2016	11	14	27	52
1987	9	15	20	44	2017	11	15	26	52
1988	9	15	21	45	2018	10	16	25	51
1989	9	15	23	47	2019	10	16	28	54
1990	9	15	27	51	2020	10	14	27	51
1991	10	15	28	53	2021	8	16	27	51
1992	11	15	34	60	2022	8	16	26	50
1993	12	15	52	79	2023	9	14	24	47
1994	12	15	61	88	**Total**	**30**	**56**	**103**	**189**

Table 1 displays our sin-stocks year by year. There are a total of 56 distinct alcohol stocks, 30 distinct tobacco stocks and 103 distinct gambling stocks. This yields a total of 199 stocks, which is due to re-classification of industry for one stock. There are few sin stocks relative to the thousands of stocks across different industries. While the numbers of tobacco and alcohol stocks

have stayed relatively constant through the years, the number of gambling stocks surged through the mid and late 1990s with the ongoing deregulation of the gambling industry (Hong and Kacperczyk 2009). We provide a table of yearly distribution for the comparable industries in Table 14 in the appendix.

2.2. Construction and Selection of Comparable Stocks Sample

In accordance with Hong and Kacperczyk (2009) we identify comparable non-sin stocks as those belonging to the Fama and French (1997) industry groups 2 (food), 3 (Soda), 7 (fun) and 43 (meals and hotels). The authors explain that in some classification schemes, beer is often lumped together with soda, as is tobacco with food and gaming with fun and meals. One could argue for more specific comparable definitions, but we follow the method of Hong and Kacperczyk (2009) for comparability and find our sin sample to exhibit a very high correlation with the comparable stocks. From the comparable stocks industry groups, we obtain SIC codes used to screen CRSP for our comparable stocks. As we are only interested in stocks that belong to these industry groups, it is not necessary to screen on the industry level. This search gives us 1640 unique stocks. Next, we filter on Share Codes 10 and 11 as with the sin dataset, which gives us 1501 unique stocks. Next, we filter the comparable dataset to exclude all companies that are present in the sin dataset by PERMNO. This is important since gambling stocks are not distinguished from the industry groups Meals and Hotels and Fun. We now have 1413 stocks. Next, we filter on our SIC codes again to ensure that CRSP has not included any other industries, we now have 1392. Lastly, we manually screen the companies and exclude any companies that belong to sin industries. We find 28 sin stocks in the sample. They are all small companies, and they are not present in the Compustat database, otherwise they would have been filtered out by PERMNO. These companies are not included in our sin stock sample as they were not identified through our sin stock screening in Compustat. We are left with a dataset of 1364 comparable non-sin stocks that are or have been trading on NYSE, NASDAQ or AMEX. This is our final comparable stock sample.

2.3. Data and portfolio construction

We use monthly return data from CRSP to run time-series regressions across several factor models. We obtain monthly returns, closing prices and shares outstanding for NYSE, Amex and Nasdaq stocks over the period 1965-01 to 2023-12. The data used in the asset pricing models, including the risk-free rate, the value-weighted market premium and Fama and French factors size, value, profitability, investment and the Carhart factor momentum are obtained from Kenneth French's data library. The monthly return data over the sample period yields a sample size of 35 684 observations for the total portfolio of sin stocks and 153 352 observations for the total portfolio of comparable stocks. Only missing return data in 717 observations (2%) for our sin portfolio and 4 136 observations (2.7%) for our comparable portfolio. Missing values are filtered out. Survivorship bias is not an issue as both Compustat and CRSP include historical companies, independent of their current trading status. Therefore, our samples include active and non-active stocks that have been delisted for reasons such as acquisitions, bankruptcy and change of exchange.

2.4. Variables in time-series return regressions

This section introduces the variables used in the regressions to analyze the abnormal returns of sin stocks and their relationship with established risk factors.

2.4.1. Dependent Variables

Our study examines the abnormal returns of sin stocks through the construction of various dependent variables. For the value-weighted analysis, we create the following portfolios: SIN, representing the value-weighted monthly excess return of all sin stocks; ALCOHOL, for the alcohol portfolio; TOBACCO, for the tobacco portfolio; and GAMBLING, for the gambling portfolio. The focus on value-weighted portfolios ensures consistency with the market portfolio (MKTPREM), aligns with recent literature, and reflects realistic capital allocation and liquidity preferences in developed markets, where large firms dominate.

For the equal-weighted analysis, we construct SINEW-COMPSEW, an equal-weighted long-short portfolio that is long on our sin stocks (SINEW) and short on our comparable non-sin stocks (COMPSEW). This approach isolates the "sin premium" following Hong and Kacperczyk (2009). Equal weighting is employed to allow direct comparability with their study and assess whether the significant alpha of the long-short portfolio persists under the FF5 model.

2.4.2. Independent Variables

The data for the independent variables is obtained from Kenneth French's data library which provides value-weighted average monthly returns throughout the entire study period. MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. The risk-free rate (RF) is represented by the one-month Treasury bill rate.

2.5. Asset Pricing Models

We employ several asset pricing models to study the return performance of our sin portfolios. In this section, we briefly explain the theory and specify the models for dependent variables.

2.5.1. Capital Asset Pricing Model

We begin with the Capital Asset Pricing Model (CAPM) with Jensen's alpha as a measure of abnormal performance. Developed by Jensen (1968), Jensen's alpha quantifies the extent to which a portfolio's realized returns deviate from its expected returns based on systematic market

risk, as captured by the Sharpe-Lintner CAPM (Sharpe 1964; Lintner 1965). The specification is as follows:

$$SIN_t = \alpha_p + \beta_p(MKTPREM_t) + \epsilon_t$$

In this model, SIN_t is the monthly excess return of the SIN portfolio, which can be replaced by ALCOHOL, TOBACCO, GAMBLING, or SINEW-COMPSEW. The coefficient beta_p reflects sensitivity to market risk (MKTPREM_t), while epsilon_t is a random error term. Jensen's alpha (alpha_p) measures the portfolio's abnormal return, with positive values indicating outperformance and negative values indicating underperformance.

2.5.2. Fama French Three-Factor Model

While the CAPM is fundamental in finance, it faces criticism for its inability to explain return anomalies beyond systematic market risk. Fama and French (1992, 1993) addressed these limitations by introducing the Three-Factor Model, which extends the CAPM by incorporating two additional factors: Small minus Big (SMB), capturing the size effect, and High minus Low (HML), capturing the value effect. These factors enhance the explanatory power of CAPM in evaluating stock performance. We extend the CAPM specification to the three-factor model regression as follows:

$$SIN_t = \alpha_p + \beta_p(MKTPREM_t) + \gamma_p(SMB_t) + \delta_p(HML_t) + \epsilon_t$$

Here, SMB_t and HML_t are the size and value factors, respectively, while gamma_p and delta_p measure the portfolio's sensitivity to these risks. All other variables, including MKTPREM_t, epsilon_t, alpha_p, and beta_p, remain the same as in the CAPM. This model builds on CAPM by accounting for firm-specific characteristics, offering a more comprehensive framework for explaining stock returns.

2.5.3. Carhart Four-Factor Model

Carhart (1997) extends the Fama-French Three-Factor Model by introducing a momentum factor (MOM), which captures the tendency of stocks with strong past performance (winners) to continue outperforming and stocks with poor past performance (losers) to underperform. This strategy is based on prior 3–12 month returns. The Carhart model is specified as:

$$SIN_t = \alpha_p + \beta_p(MKTPREM_t) + \gamma_p(SMB_t) + \delta_p(HML_t) + \mu_p(MOM_t) + \epsilon_t$$

Here, MOM_t represents the momentum factor, and mu_p is the portfolio's sensitivity to this factor. All other variables and coefficients are as defined in the Fama-French Three-Factor Model.

2.5.4. Fama-French Five-Factor Model

Fama and French (2015) address limitations in the Three-Factor Model, particularly its inability to explain return variations related to profitability and investment. They expand the model by incorporating two additional factors: Robust minus Weak (RMW), which reflects the return difference between portfolios of firms with high (robust) and low (weak) profitability, and Conservative minus Aggressive (CMA), which captures the return difference between firms with low (conservative) and high (aggressive) investment levels (asset growth). These factors enhance the model's explanatory power, capturing dimensions of stock performance that earlier models could not. The model is specified as:

$$SIN_t = \alpha_p + \beta_p(MKTPREM_t) + \gamma_p(SMB_t) + \delta_p(HML_t) + \rho_p(RMW_t) + \tau_p(CMA_t) + \epsilon_t$$

Here, RMW_t represents the profitability factor, and CMA_t represents the investment factor. The coefficients rho_p and tau_p indicate the portfolio's sensitivity to these respective factors. All other variables are as defined in the Fama-French Three-Factor Model.

3. Empirical Results

This section presents the results for the SIN portfolio over the entire period (1965-2023) and in subperiods (1965-1985, 1986-2006 and 2007-2023). We present our results for the industry segmentation of ALCOHOL, TOBACCO and GAMBLING over the entire period (1965-2023), and in the extension period (2007-2023). This section ends with presenting the results of the (SINEW-COMPSEW) over 1965-2023. We use ordinary least squares with Newey-West standard errors to control for heteroscedasticity and serial autocorrelation of the error terms.

3.1. The SIN portfolio

In this section we present the results of the time series regressions on the SIN portfolio for the CAPM, FF3 model, Carhart model and FF5 model.

Table 2: Summary Statistics of Value-Weighted Returns and Factors (1965–2023)

This table summarizes the value-weighted monthly returns for sin portfolios, individual industry portfolios, and market factors over the period 1965–2023. The dependent variables include SIN, ALCOHOL, TOBACCO, and GAMBLING, which represent the value-weighted monthly excess returns of the sin portfolio, alcohol portfolio, tobacco portfolio, and gambling portfolio, respectively. The independent variables include MKTPREM, the excess monthly return of the value-weighted CRSP index; RF, the risk-free rate represented by the one-month Treasury bill rate; SMB, the return of a portfolio long on small stocks and short on large stocks; HML, the return of a portfolio long on high book-to-market stocks and short on low book-to-market stocks; MOM, the return of a portfolio long on

past 12-month winners and short on past 12-month losers; RMW, the return of a portfolio long on stocks with robust operating profitability and short on those with weak operating profitability; and CMA, the return of a portfolio long on stocks with conservative investment strategies and short on those with aggressive investment strategies. For each variable, the table reports the mean, median, minimum, maximum, standard deviation (SD), and the number of observations (N).

Variable	Mean	Median	Min	Max	N	SD
SIN (%)	1.27	1.33	-21.31	20.60	708	5.32
ALCOHOL (%)	1.08	1.10	-22.17	24.78	708	5.23
TOBACCO (%)	1.20	1.50	-21.88	30.83	708	6.15
GAMBLING (%)	1.71	1.63	-46.28	92.00	650	11.28
MKTPREM (%)	0.56	0.91	-23.24	16.10	708	4.55
RF (%)	0.36	0.38	0.00	1.35	708	0.27
SMB (%)	0.23	0.10	-15.32	18.28	708	3.07
HML (%)	0.28	0.22	-13.88	12.80	708	3.02
MOM (%)	0.60	0.73	-34.30	18.20	708	4.26
RMW (%)	0.29	0.27	-18.65	13.07	708	2.25
CMA (%)	0.27	0.09	-7.20	9.07	708	2.09

The summary statistics in Table 2 provide an overview of the value-weighted returns and factor variables for the period 1965-2023. The SIN portfolio exhibits a mean monthly return of 1.27% with a standard deviation (SD) of 5.32%. Among the sin industries GAMBLING displays the highest mean return (1.71%) and the largest SD (11.28%), reflecting greater risk and return volatility. ALCOHOL and TOBACCO have lower mean returns of 1.08% and 1.20% respectively but exhibit a more stable SD of 5.23% and 6.15%. The MKTPREM averages 0.56% with a SD of 0.27%. Factor loadings for SMB, HML, MOM, RMW and CMA show moderate variation with mean values ranging between 0.23% and 0.60%. The statistics point out the higher risk-return dynamics of sin stocks relative to standard factor benchmarks.

Table 3: Regression Results for SIN Portfolio (1965-2023, Value-Weighted Returns)

This table displays the regression results for the SIN portfolio using factor models for the period 1965–2023. SIN represents the value-weighted monthly excess return of all sin stocks, including alcohol, tobacco, and gambling. The regressions are performed using the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, the Carhart Four-Factor Model, and the Fama-French Five-Factor Model. ALPHA represents the intercept (abnormal return) of the regression. MKTPREM represents the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating

profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. Newey-West standard errors are reported in parentheses. Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%. Adjusted R^2 and the number of observations (#obs.) are also reported for each regression model.

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
SIN	0.0081***	0.8360***						0.5097	708
	(0.0017)	(0.0621)							
SIN	0.0073***	0.8819***	-0.0625	0.2465***				0.5279	708
	(0.0015)	(0.0403)	(0.0594)	(0.0869)					
SIN	0.0076***	0.8719***	-0.0634	0.2302**	-0.0488			0.5286	708
	(0.0013)	(0.0470)	(0.0577)	(0.1102)	(0.0685)				
SIN	0.0042***	0.9498***	0.0922	0.0278		0.6064***	0.4263***	0.5871	708
	(0.0013)	(0.0379)	(0.0605)	(0.0739)		(0.0921)	(0.1046)		

Our results in Table 3 show a consistent and robust sin premium over the entire study period. The SIN portfolio generates positive and significant alpha across all models, even with the inclusion of the FF5 model. The estimated alpha ranges from 81 bps for CAPM to 42 bps in the Fama-French five-factor model, and significant at the 1% level through all models. The findings suggest that sin stocks generate positive abnormal returns in the U.S. from 1963 to 2023, even after accounting for established risk factors. The gradual decline in alpha across the models reflects the explanatory power of the additional risk factors. For example, in the Fama-French five-factor model, which is our most conservative model, the MKTPREM, RMW and CMA factors are all significant at the 1% level and positive. The market factor ranging from 83.60 to 94.98 bps, significant at the 1% level across all models, shows that sin stocks are more defensive than the market. The profitability and investment factors of 60.64 and 42.63 bps significant at the 1% level in the FF5 model show that the sin stocks in our sample exhibit robust profitability and follow conservative investment strategies. Our results in Table 3 are not consistent with the findings of Blitz and Fabozzi (2017), Richey (2017), Sagbakken and Zhang (2022). In all three studies alpha remains positive and significant at the 1% level (Richey 2017) or 5% level (Blitz and Fabozzi 2017, Sagbakken and Zhang 2022) for the Carhart four-factor model. However, in all three studies the alpha becomes insignificant, yet positive, when adding the profitability (RMW) and investment (CMA) factors. Our findings oppose these studies who suggest that the positive abnormal returns of sin stocks vanish under the FF5 model. But, the adjusted R-squared values increase with the inclusion of the additional factors, growing from 0.5097 in the CAPM to 0.5871 in the FF5 model. This improvement points out the contribution of the RMW and CMA factors. The increase in adjusted R-squared for more conservative models demonstrates that these additional factors provide a better explanation for the returns. However, alpha remains significant for the FF5 model suggesting that not all drivers of the sin premium are captured by the models.

3.2. Time Segmentation

This section presents the results for the time-series regressions of the SIN portfolio over three time periods, 1965-1985, 1986-2006 and 2007-2023, all else equal. Our timeframe covers a long period, and the time segmentation enables analysis of how the performance of sin stocks and exposure to factors have evolved over time. The results of the segmented time-series regressions

of SIN are presented in Table 4. The results reveal notable temporal changes in the drivers of sin stock returns and the explanatory power of the models.

Table 4: Regression Results for SIN Portfolio by Sub-Period Panels (1965-2023, Value-Weighted Returns)

This table presents the regression results for the SIN portfolio by sub-period panels (1965–2023) using value-weighted returns. SIN represents the value-weighted monthly excess return of all sin stocks, including alcohol, tobacco, and gambling. The regressions are conducted separately for three sub-periods: 1965–1985 (Panel A), 1986–2006 (Panel B), and 2007–2023 (Panel C). Each regression is performed under the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, the Carhart Four-Factor Model, and the Fama-French Five-Factor Model. ALPHA represents the intercept (abnormal return) of the regression. MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. Newey-West standard errors are reported in parentheses. Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%. Adjusted R^2 and the number of observations (#obs.) are also reported for each regression model.

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
Panel A: (1965-1985)									
SIN	0.0076***	0.9207***						0.6884	252
	(0.0017)	(0.0562)							
SIN	0.0073***	0.9327***	-0.0074	0.0485				0.6864	252
	(0.0019)	(0.0630)	(0.0793)	(0.0908)					
SIN	0.0083***	0.9276***	-0.0155	0.0265	-0.0861			0.6890	252
	(0.0020)	(0.0591)	(0.0752)	(0.0793)	(0.0764)				
SIN	0.0065***	0.9509***	0.0196	-0.0027		0.1673	0.2124	0.6868	252
	(0.0020)	(0.0627)	(0.0764)	(0.1114)		(0.1471)	(0.1529)		
Panel B: (1986-2006)									
SIN	0.0107***	0.6938***						0.2881	252
	(0.0038)	(0.1184)							
SIN	0.0079**	0.8359***	-0.0449	0.4490**				0.3307	252
	(0.0031)	(0.0740)	(0.1067)	(0.1854)					
SIN	0.0079***	0.8365***	-0.0453	0.4497**	0.0036			0.3280	252
	(0.0030)	(0.0787)	(0.1085)	(0.1982)	(0.1092)				
SIN	0.0026	1.0166***	0.2064*	-0.1845		0.9395***	0.7290***	0.4760	252
	(0.0029)	(0.0629)	(0.1098)	(0.1447)		(0.1469)	(0.1664)		
Panel C: (2007-2023)									
SIN	0.0058***	0.8937***						0.6515	204
	(0.0021)	(0.0565)							
SIN	0.0062***	0.8926***	-0.1211	0.2142***				0.6656	204

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R²	#obs.
	(0.0021)	(0.0524)	(0.0994)	(0.0722)					
SIN	0.0064***	0.8558***	-0.1478	0.1715**	-0.1226			0.6731	204
	(0.0021)	(0.0537)	(0.0997)	(0.0823)	(0.0755)				
SIN	0.0047**	0.9181***	-0.0267	0.1086		0.2671**	0.2130	0.6756	204
	(0.0020)	(0.0499)	(0.1093)	(0.0825)		(0.1281)	(0.1384)		

In Panel A, 1965-1985, the SIN portfolio delivers a positive and significant alpha for all models. The alphas range between 65 and 83 bps, significant at the 1% level across models.

In Panel B, 1986-2006, the alpha becomes insignificant for the FF5 model. The effect of including the FF5 model here is substantial as alpha switches from 79 bps significant at the 1% level for the Carhart model, to 26 bps and insignificant for the FF5 model. This indicates that the observed positive and significant alpha under less conservative factor models can be explained by the profitability and conservative investment in this time segment. The results show strongly positive and significant RMW and CMA coefficients in the FF5 model. This indicates that sin stocks in this period exhibited robust profitability and pursued low-risk investment strategies which contributed to their returns. The results in this period are consistent with studies proposing that the observed alpha for sin stocks become insignificant for the FF5 model (Richey 2017, Blitz and Fabozzi 2017, Sagbakken and Zhang 2022).

However, the period of certain interest is the 2007-2023 period, presented in Panel C. In the most recent period, the SIN portfolio shows positive alphas significant at the 1% level for CAPM, FF3 and Carhart, and at the 5% level for FF5. The alpha estimated with the FF5 model is 47 bps, slightly lower magnitude in comparison to the less conservative models. The results do not show evidence of increasing abnormal returns for the SIN portfolio over time. They do however show that from the period where Hong and Kacperczyk (2009) left, and up to the present (2007-2023), the abnormal returns of sin stocks in the U.S. have persisted. This holds for the FF5 model, contrasting studies who argue that the abnormal returns of sin stocks vanish under the Fama and French (2015) quality factors. This can possibly be explained by an increase in exclusionary screening (GSIA 2018, GSIA 2022) from investors adhering to sustainable practices during this period. In line with Hong and Kacperczyk (2009) systematic neglect of sin stocks leads to limited risk sharing and may explain the persistence of the abnormal returns of sin stocks. In addition, the findings of Zerbib (2022) in that exclusionary screening has a significant impact on asset prices and increase the cost of capital for excluded stocks further supports this notion.

The results from the segmented time-series regression provide evidence of persistent and statistically significant positive abnormal returns of the SIN portfolio across the period 1965-2023.

3.3. Industry Segmentation

Next, we segment the industries and analyze the performance of ALCOHOL, TOBACCO and GAMBLING individually over the period 1965-2023, all else equal. We segment the industries

to assess how each industry behaves and differ in their factor sensitivities and alpha for the different models. The results are presented in Table 5.

Table 5: Regression Results for Industry Portfolios (1965–2023, Value-Weighted Returns)

This table presents regression results for industry portfolios ALCOHOL, TOBACCO, and GAMBLING across various factor models using value-weighted returns for the period 1965–2023. ALCOHOL represents the value-weighted monthly excess return of the alcohol portfolio. TOBACCO represents the value-weighted monthly excess return of the tobacco portfolio. GAMBLING represents the value-weighted monthly excess return of the gambling portfolio. The regressions are based on the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, the Carhart Four-Factor Model, and the Fama-French Five-Factor Model. ALPHA represents the intercept (abnormal return) of the regression. MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. Newey-West standard errors are reported in parentheses. Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%. Adjusted R^2 and the number of observations (#obs.) are also reported for each regression model.

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
Panel A: ALCOHOL (1965-2023)									
ALCOHOL	0.0066***	0.7676***						0.4446	708
	(0.0016)	(0.0791)							
ALCOHOL	0.0062***	0.7910***	-0.0342	0.1221				0.4481	708
	(0.0015)	(0.0597)	(0.0651)	(0.1001)					
ALCOHOL	0.0058***	0.7993***	-0.0334	0.1357	0.0408			0.4483	708
	(0.0015)	(0.0624)	(0.0691)	(0.1137)	(0.0743)				
ALCOHOL	0.0033**	0.8447***	0.1314**	-0.0295		0.6615***	0.2684***	0.5151	708
	(0.0014)	(0.0482)	(0.0566)	(0.0622)		(0.0883)	(0.0980)		
Panel B: TOBACCO (1965-2023)									
TOBACCO	0.0080***	0.7200***						0.2820	708
	(0.0021)	(0.0530)							
TOBACCO	0.0073***	0.8036***	-0.2349***	0.2797***				0.3092	708
	(0.0019)	(0.0500)	(0.0800)	(0.1020)					
TOBACCO	0.0074***	0.8011***	-0.2351***	0.2756**	-0.0121			0.3083	708
	(0.0018)	(0.0557)	(0.0811)	(0.1113)	(0.0683)				
TOBACCO	0.0036*	0.8985***	-0.0649	-0.0499		0.6531***	0.6716***	0.3692	708
	(0.0019)	(0.0474)	(0.0932)	(0.0848)		(0.1152)	(0.1202)		
Panel C: GAMBLING (1965-2023)									
GAMBLING	0.0086**	1.4562***						0.3542	650
	(0.0044)	(0.1344)							
GAMBLING	0.0072**	1.3142***	1.0437***	0.2888				0.4342	650
	(0.0036)	(0.1176)	(0.2342)	(0.2245)					
GAMBLING	0.0103***	1.2302***	1.0176***	0.1609	-0.3854*			0.4535	650
	(0.0036)	(0.0876)	(0.2018)	(0.1719)	(0.1981)				

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
GAMBLING	0.0064*	1.2830***	1.2011***	0.4817**		0.5888***	-0.5465**	0.4514	650
	(0.0033)	(0.1126)	(0.1810)	(0.2180)		(0.2236)	(0.2667)		

We find positive and significant alphas across all models in the three industry segmented portfolios. The significance is decreasing in the most conservative models, indicating that they capture more unexplained returns from the less conservative models. The ALCOHOL alpha ranges from 66 bps under CAPM (significant at the 1% level), to 33 bps under FF5 (significant at the 5% level). The TOBACCO alpha starts at 80 bps for CAPM (significant at the 1% level) and decreases to 36 bps for the FF5 model (significant at the 10% level). The GAMBLING alpha is the highest among the three industries, starting at 86 bps for CAPM (significant at the 1% level) and decreases to 64 bps for the Fama-French five-factor model (significant at the 10% level). We also see that the market premium, profitability and investment factors are significant across the industries. Notably, GAMBLING displays a higher sensitivity to the market than TOBACCO and ALCOHOL. Furthermore, GAMBLING has a high magnitude in SMB which suggests that the gambling stocks are smaller in size. GAMBLING also has negative and significant exposure to CMA (-54.65 bps under FF5) as opposed to ALCOHOL and GAMBLING, which suggests that gambling stocks exhibit aggressive investment practices. ALCOHOL is significant at the 5% level in the Fama French (2015) five-factor model, while TOBACCO and GAMBLING are significant at the 10% level. The findings suggest that over the entire period 1965-2023 each of the sin industries in our sample generate positive abnormal returns.

To our knowledge only two previous studies segment their respective sin portfolio on the industry level to further examine the performance of sin stocks, that is Richey (2017) and Fabozzi, Ma and Oliphant (2008). Our results show that each of the industries over the period 1965-2023 generate positive and significant alpha for the Fama-French five-factor model. In contrast, Richey (2017) shows that the alcohol and tobacco portfolios become insignificant under the FF5 model, yet positive. For the CAPM, FF3, and Carhart model the alphas for the alcohol and tobacco portfolios are positive and significant. The gambling portfolio of Richey (2017) is insignificant across all models. Fabozzi et al. (2008) show that a global sample of alcohol, tobacco and gambling stocks on an annual basis outperform the market by 5.27%, 14.71% and 26.35% respectively, all significant at the 1% level, over the period 1970-2007. We find that gambling stocks outperform both alcohol and tobacco in terms of alpha magnitude which aligns with Fabozzi et al. (2008). However, one should be careful since our setting contrasts with theirs in several ways. For example, we employ time-series regression with factor models, and Fabozzi et al. (2008) do not.

We continue the analysis and provide the results for ALCOHOL, TOBACCO and GAMBLING over the period 2007-2023 in Table 6.

Table 6: Regression Results for Industry Portfolios (2007–2023, Value-Weighted Returns)

This table displays regression results for industry portfolios ALCOHOL, TOBACCO, and GAMBLING for the period 2007–2023, using value-weighted returns. ALCOHOL represents the value-weighted monthly excess return of the alcohol portfolio. TOBACCO represents the value-weighted monthly excess return of the tobacco portfolio. GAMBLING represents the value-weighted monthly excess return of the gambling portfolio. The results are based on the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, the Carhart Four-Factor Model, and the Fama-French Five-Factor Model. ALPHA represents the intercept (abnormal return) of the regression.

MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. Newey-West standard errors are reported in parentheses. Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%. Adjusted R^2 values and the number of observations (#obs.) are also reported for each regression model.

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
Panel A: ALCOHOL (2007-2023)									
ALCOHOL	0.0090***	0.7651***						0.4753	204
	(0.0028)	(0.0691)							
ALCOHOL	0.0091***	0.7410***	0.1421	-0.0473				0.4744	204
	(0.0028)	(0.0725)	(0.1257)	(0.0809)					
ALCOHOL	0.0089***	0.7564***	0.1533	-0.0294	0.0515			0.4733	204
	(0.0027)	(0.0751)	(0.1221)	(0.0688)	(0.1133)				
ALCOHOL	0.0067***	0.7592***	0.3084**	-0.1160		0.5401***	0.0703	0.5045	204
	(0.0025)	(0.0617)	(0.1471)	(0.0923)		(0.1748)	(0.1288)		
Panel B: TOBACCO (2007-2023)									
TOBACCO	0.0047*	0.6247***						0.3204	204
	(0.0027)	(0.0580)							
TOBACCO	0.0049*	0.6875***	-0.5234***	0.3832***				0.4015	204
	(0.0026)	(0.0599)	(0.1275)	(0.1014)					
TOBACCO	0.0049*	0.6897***	-0.5218***	0.3858***	0.0073			0.3985	204
	(0.0026)	(0.0618)	(0.1283)	(0.1057)	(0.0580)				
TOBACCO	0.0024	0.7528***	-0.3843***	0.1060		0.3210*	0.6297***	0.4462	204
	(0.0028)	(0.0598)	(0.1309)	(0.1065)		(0.1724)	(0.1688)		
Panel C: GAMBLING (2007-2023)									
GAMBLING	0.0018	1.8608***						0.5392	204
	(0.0048)	(0.1860)							
GAMBLING	0.0036	1.6670***	0.7699**	0.2532				0.5716	204
	(0.0051)	(0.1316)	(0.2965)	(0.1756)					
GAMBLING	0.0054	1.4069***	0.5813***	-0.0491	-0.8668**			0.6574	204
	(0.0044)	(0.1227)	(0.2148)	(0.1748)	(0.3408)				
GAMBLING	0.0044	1.6181***	0.7509**	0.4663**		0.0604	-0.5412*	0.5722	204
	(0.0047)	(0.1283)	(0.3753)	(0.2076)		(0.4524)	(0.3056)		

Panel A of Table 6 shows that the ALCOHOL portfolio continued to deliver a positive alpha significant at the 1% level across all models during 2007-2023. The magnitude of the ALCOHOL alpha is larger in this period for the FF5 model (67 bps significant at the 1% level), in comparison to the ALCHOL alpha estimated over the entire period for the FF5 model (33 bps significant at the 5% level). In addition, the coefficients for MKTPREM, SMB and RMW are positive and significant under the Fama-French five factor model, and here the magnitude of

alpha is the lowest. These results suggest that the market, size, and profitability factors provided explanatory power for the alpha of the alcohol industry in this period.

In Panel B of Table 6 the results show that the TOBACCO alpha declined sharply in magnitude for the Fama-French five-factor model. Across CAPM to the Carhart model the alpha ranged from 47 to 49 bps, significant at the 10% level. In our most conservative model, the alpha is estimated to 24 bps and insignificant.

Panel C of Table 6 presents that the GAMBLING portfolio alpha is positive but insignificant across all models in this time segment and varies in magnitude. For CAPM alone the alpha is insignificant and the beta amounts to 186 bps, significant at the 1% level, suggesting that exposure to market risk alone during this period may explain the returns of the GAMBLING portfolio. The findings presented in Panel B and Panel C align with the findings of Richey (2017), i.e. that the alpha for tobacco stocks become insignificant under the FF5 model, and that the gambling alpha alone is insignificant across all models.

The difference between the results for the sin industries over the entire period (1965-2023) and the most recent period (1965-2023) indicates that the systematic exclusion of these industries, which has been argued to rectify the abnormal returns of sin stocks (Hong and Kacperczyk 2009), may not persist for the tobacco and gambling industries today. As panel A in Table 6 shows only the ALCOHOL portfolio delivers a positive significant alpha under the FF5 model during 2007-2023.

3.4. Long-short portfolio

This section examines the performance of an equal-weighted long-short portfolio, consistent with the methodology of Hong and Kacperczyk (2009). The portfolio is constructed by taking a long position in sin stocks and a short position in their comparable stocks, enabling a direct comparison of returns. This approach isolates the sin premium by accounting for the performance of similar non-sin stocks, providing an alternative perspective on whether sin stocks truly deliver abnormal returns. The results are evaluated across all factor models to assess their robustness and are complemented by a placebo test to examine whether observed outperformance is driven by random noise.

Table 7: Summary Statistics of Equal-Weighted Returns for Portfolios and Market Factors (1965–2023)

This table provides summary statistics for equal-weighted returns for SIN portfolios and market factors for the period 1965–2023. SINEW-COMPSEW represents the equal-weighted long-short portfolio that is long on sin stocks (SINEW) and short on comparable non-sin stocks (COMPSEW). SINEW is the equal-weighted monthly excess return of the sin stock portfolio, and COMPSEW is the equal-weighted monthly excess return of the comparable non-sin stock portfolio. MKTPREM is the excess monthly return of the value-weighted CRSP index. RF represents the one-month Treasury bill rate as the risk-free rate. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. The table reports the mean, median, minimum, maximum, number of observations (N), and standard deviation (SD) for each variable.

Variable	Mean	Median	Min	Max	N	SD
SINEW-COMPSEW (%)	0.24	0.09	-8.74	13.38	708	2.85
SINEW (%)	0.98	0.93	-28.65	43.74	708	6.07
COMPSEW (%)	0.73	1.00	-27.90	30.36	708	5.59
MKTPREM (%)	0.56	0.91	-23.24	16.10	708	4.55
RF (%)	0.36	0.38	0.00	1.35	708	0.27
SMB (%)	0.23	0.10	-15.32	18.28	708	3.07
HML (%)	0.28	0.22	-13.88	12.80	708	3.02
MOM (%)	0.60	0.73	-34.30	18.20	708	4.26
RMW (%)	0.29	0.27	-18.65	13.07	708	2.25
CMA (%)	0.27	0.09	-7.20	9.07	708	2.09

The summary statistics in Table 7 provide an overview of the equal-weighted portfolio returns and associated factor variables for the period 1965-2023. The SINEW-COMPSEW portfolio representing the long-short portfolio yields a mean monthly return of 0.24% with a SD of 2.85%. The SINEW portfolio generates a higher mean return of 0.98% with a SD of 6.07%. The COMPEW portfolio has a lower mean return of 0.73% and a SD of 5.59%.

Table 8: Correlation Test Between SINEW and COMPSEW (1965–2023)

This table reports the correlation test results between the equal-weighted monthly excess returns of the SINEW portfolio and the COMPSEW portfolio for the period 1965–2023. SINEW represents the equal-weighted monthly excess return of the sin stock portfolio, while COMPSEW represents the equal-weighted monthly excess return of the comparable non-sin stock portfolio. The table provides the correlation coefficient alongside the lower and upper bounds of the 99% confidence interval.

Variable 1	Variable 2	Correlation	Lower Bound	Upper Bound
SINEW	COMPSEW	0.88	0.86	0.9

Table 8 shows the correlation between the SINEW and COMPSEW portfolios over the period 1965-2023. They exhibit a correlation of 0.88 which is statistically significant at the 1% level. Given this level of correlation, we conclude that the industries Food, Soda, Fun and Meals & Hotels are appropriate comparable firms to the sin industries alcohol, tobacco and gambling as it indicates that their returns are affected by similar market factors such as economic cycles and consumer spending.

Table 9: Regression Results for SINEW-COMPSEW (Equal-weighted, 1965-2023)

This table presents regression results for the SINEW-COMPSEW portfolio over the period 1965–2023. SINEW-COMPSEW is an equal-weighted long-short portfolio that is long on sin stocks (SINEW) and short on comparable non-sin stocks (COMPSEW). The regressions are performed using the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, the Carhart Four-Factor Model, and the Fama-French Five-Factor Model. ALPHA represents the intercept (abnormal return) of the regression. MKTPREM represents the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. RMW is the return of a portfolio that is long on stocks with robust operating profitability and short on stocks with weak operating profitability. CMA is the return of a portfolio that is long on stocks with conservative investment strategies and short on stocks with aggressive investment strategies. Coefficients are reported with Newey-West standard errors in parentheses. Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%. The table also includes Adjusted R^2 values and the number of observations (#obs.) for each regression model.

Variable	ALPHA	MKTPREM	SMB	HML	MOM	RMW	CMA	Adj.R^2	#obs.
SINEW-COMPSEW	0.0022*	0.0397						0.0026	708
	(0.0013)	(0.0338)							
SINEW-COMPSEW	0.0019	0.0759***	-0.1048**	0.1166***				0.0249	708
	(0.0013)	(0.0274)	(0.0437)	(0.0377)					
SINEW-COMPSEW	0.0023*	0.0657**	-0.1057**	0.1000**	-0.0495			0.0285	708
	(0.0012)	(0.0261)	(0.0434)	(0.0430)	(0.0412)				
SINEW-COMPSEW	0.0021*	0.0727***	-0.1149**	0.1252***		-0.0402	-0.0149	0.0229	708
	(0.0012)	(0.0277)	(0.0475)	(0.0472)		(0.0506)	(0.1032)		

In Table 9 the results for the time series regression of the equal weighted long-short portfolio over 1965-2023 are presented. Here we mirror the setting of Hong and Kacperczyk (2009) but extend the time frame to cover 2007-2023 and include the FF5 model to test if their findings hold under this setting.

The CAPM yields an alpha of 22 bps a month which is significant at the 10% level. The Fama-French three-factor model yields a positive but insignificant alpha of 19 bps. In the Carhart four-factor model the alpha becomes significant again at the 10% level and amounts to 23 bps. The Fama-French five-factor model yields an alpha of 21 bps and remains significant at the 10% level. The alpha is positive across all models and statistically significant at the 10% level in most cases, apart from FF3. In comparison to the findings of Hong and Kacperczyk (2009) our results are similar. Their equal weighted long short portfolio yielded alphas of 25 bps significant at the 10% level, 26 bps at the 10 % level and 26 bps at the 10 % level for the CAPM, FF3 model and Carhart model. In contrast to Hong and Kacperczyk (2009), our most conservative model includes the profitability (RMW) and investment (CMA) factors. As per our results alpha

remains positive and significant with the inclusion of these factors, meaning that over the period 1965-2023 the inclusion of these factors does not help to explain the return premium the triumvirate of sin experience over their comparable stocks. The low adjusted R-squared across the models indicates that the model has low explanatory power of the return difference between SINEW and COMPSEW. This indicates that the observed return difference stems from other factors than what the model can explain. As suggested by Hong and Kacperczyk (2009), social norms and the systematic exclusion by an important set of investors could explain this. In Tables 15 and 16 in the appendix, we replicate Hong and Kacperczyk's (2009) time-series regression using their original sin stock sample and find similar results, which provides additional robustness for our methodology and comparable dataset.

However, in addition to the methodology we deploy, Hong and Kacperczyk (2009) also use cross-sectional variation to investigate whether sin stocks outperform other comparable stocks. While their cross-sectional regressions yield nearly identical results as the time series regression the authors emphasize that one needs to adequately control for other characteristics that are correlated with a stock's sin status to capture a pure effect of a stock being classified as sin. Sagbakken and Zhang (2022) employed the methodology of Hong and Kacperzyk (2009), i.e. cross-sectional regression controlling for individual characteristics, and found no evidence of sin stocks outperforming their comparable stocks. For this reason, we want to further investigate the robustness of our results, and test if the observed alpha is unique to the sin stock classification.

3.4.1. Placebo Test

To investigate whether the observed alpha is inherently tied to the sin stock classification or driven by random noise, we perform a placebo test. This test involves randomly assigning sin status to 188 comparable stocks (COMPS) and constructing 500 randomized long-short portfolios. By rerunning the regression for these placebo portfolios, we generate a distribution of placebo alphas to compare with the observed alpha.

The null hypothesis assumes no systematic return differences between SIN and COMPS, while the alternative hypothesis posits a return difference. If the observed alpha falls within the center of the placebo distribution, we cannot reject the null hypothesis, suggesting that the return premium is due to random noise rather than an inherent sin premium.

Figure 1: Five-Factor Placebo Test for SINEW-COMPSEW (1965-2023)

This figure illustrates the results of the placebo test for the SINEW-COMPSEW portfolio (1965–2023) under the Fama-French Five-Factor Model. SINEW-COMPSEW represents an equal-weighted long-short portfolio that is long on sin stocks (SINEW) and short on comparable non-sin stocks (COMPSEW). The histogram shows the distribution of alphas (intercepts) from 500 placebo tests, where sin stock labels were randomly assigned to non-sin stocks. The red dashed line indicates the original alpha from the actual regression, and the empirical p-value quantifies the probability of observing an alpha as extreme as the original alpha for SINEW-COMPSEW under random assignment.

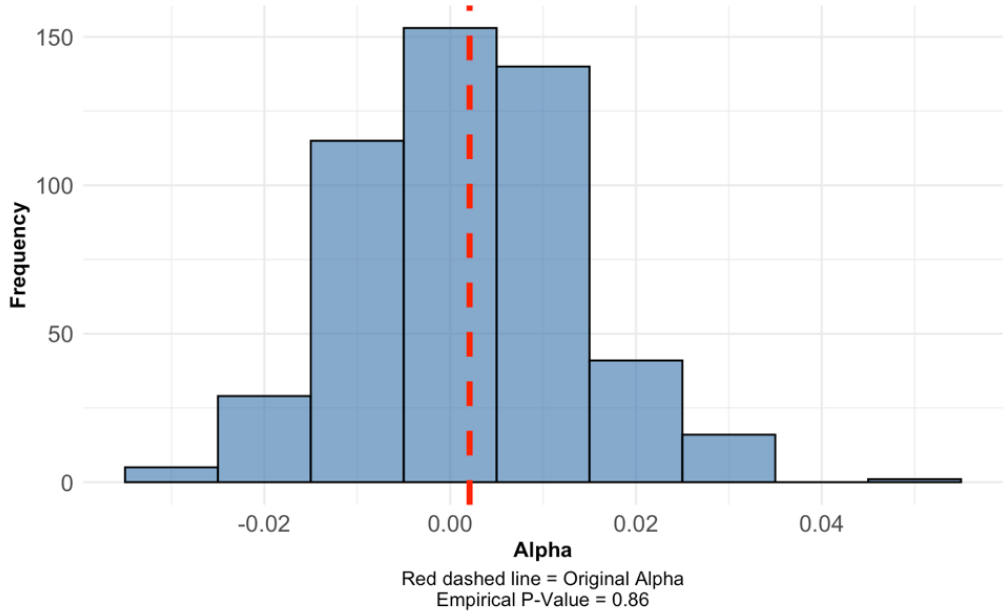


Figure 1 illustrates the placebo distributions for the Five-Factor model. The observed alpha is centered within the placebo distribution, with empirical p-value exceeding 0.05 at 0,86. This indicates that the observed alpha is not statistically distinguishable from placebo alphas, undermining the hypothesis of a persistent sin premium based solely on sin classification.

The placebo test reveals that the positive alphas generated from the SINEW-COMPSEW portfolio are likely driven by random noise rather than a systematic neglect effect tied to sin stock classification. These findings challenge the robustness of the sin premium. We perform the placebo test on Hong and Kacperczyk's (2009) original sin portfolio in Figure 3 in the appendix and find similar results.

4. Robustness

To ensure the reliability of our findings, we conduct a series of robustness checks to test the sensitivity of the results to alternative specifications, sample adjustments, and methodological changes. These tests address concerns about data dependency, model specification, and external validity.

4.1. Diagnostics for Value-weighted SIN portfolio

The diagnostic tests for the value-weighted SIN portfolio assess the validity of key regression assumptions, including homoscedasticity, autocorrelation, normality of residuals, and multicollinearity among factors. Additional robustness checks examine the stability of alpha estimates across different methods. These diagnostics ensure the reliability of our regression results and the robustness of our conclusions.

Table 10: Results of Diagnostic Tests for Assumptions of the Five-Factor Model for SIN portfolio (1965–2023, Value-weighted)

This table evaluates the assumptions of the Five-Factor Model for the SIN portfolio using three diagnostic tests: the Breusch-Pagan test for homoscedasticity, the Durbin-Watson test for autocorrelation, and the Shapiro-Wilk test for normality of residuals. The table includes the test statistic, p-value, decision and the conclusion for each test.

Test	Statistic	Null Hypothesis	P-Value	Decision	Conclusion
Breusch-Pagan Test	4.6302	Homoscedasticity (equal variance of residuals)	0.463	Fail to Reject H0	No evidence of heteroscedasticity
Durbin-Watson Test	1.9106	No first-order autocorrelation in residuals	0.113	Fail to Reject H0	No evidence of autocorrelation
Shapiro-Wilk Test	0.9785	Residuals are normally distributed	1.07e-08	Reject H0	Residuals are not normally distributed

In Table 10 the diagnostic tests verify key assumptions of the Five-Factor Model applied to the SIN portfolio. The Breusch-Pagan and Durbin-Watson tests confirm that the model satisfies the homoscedasticity and independence of errors assumptions, strengthening the validity of the regression coefficients. However, the rejection of the null hypothesis in the Shapiro-Wilk test indicates non-normality of residuals. This finding necessitates the use of complementary methods like bootstrapping or quantile regression to ensure robust inference and mitigate potential biases from non-normal distributions.

Table 11: Results of Variance Inflation Factor in Five-Factor Model Variables (1965–2023, Value-weighted)

This table presents the results of a Variance Inflation Factor (VIF) analysis to evaluate multicollinearity among independent variables in the Five-Factor Model for the SIN portfolio. The table includes the VIF values, the threshold, and the conclusion for each variable.

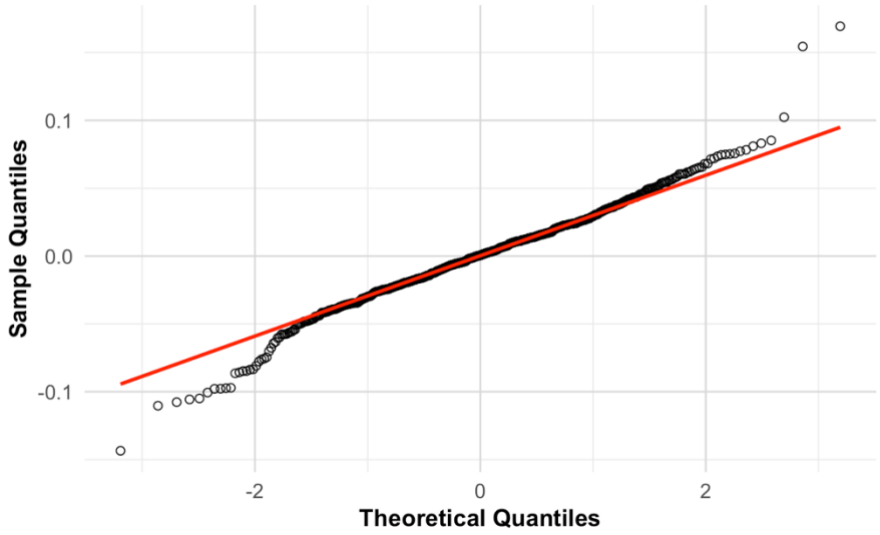
Variable	VIF	Threshold	Conclusion
MKTPREM	1.27	5	No multicollinearity concern
SMB	1.23	5	No multicollinearity concern
HML	1.96	5	No multicollinearity concern
RMW	1.20	5	No multicollinearity concern
CMA	2.16	5	No multicollinearity concern

In Table 11, the low VIF values (>5) demonstrate no multicollinearity among the independent variables in the Five-Factor Model. This strengthens our confidence in the estimated coefficients,

as they are not distorted by excessive correlations between explanatory factors. The independence of factors ensures the robustness of the model and its ability to isolate the effects of each variable on the dependent variable.

Figure 2: Q-Q Plot of SIN Residuals in the Five-Factor Model for SIN portfolio (1965–2023, Value-weighted)

This figure presents the Q-Q plot of the residuals from the Five-Factor Model for the SIN portfolio (1965–2023, value-weighted). The plot compares the sample quantiles of the residuals to the theoretical quantiles of a normal distribution. The red line represents the expected distribution under normality, and the points represent the observed residuals. Deviations from the red line indicate departures from normality.



In Figure 2, the Q-Q plot provides a visual representation of the residuals' deviations from normality, particularly in the tails. This deviation aligns with the Shapiro-Wilk test results in Table 10. While the model's assumptions are not invalidated, the observed non-normality emphasizes the importance of methods like bootstrap or quantile regression to improve the reliability of confidence intervals and hypothesis testing.

Table 12: Comparison of ALPHA Estimates: Newey-West vs. Bootstrap BCa in the Five-Factor Model for SIN portfolio (1965-2023, value-weighted)

This table compares the ALPHA (intercept) estimates, and their 99% confidence intervals obtained using two different methods: Newey-West standard errors and Bootstrap Bias-Corrected and Accelerated (BCa) intervals. The ALPHA estimate represents the value-weighted monthly excess return of SIN under the Five-Factor Model for the period 1965–2023. The table provides the point estimate, lower bound, and upper bound for each method.

Method	Alpha Estimate	Lower Bound	Upper Bound
Newey-West	0.00421	0.00074	0.00768
Bootstrap BCa	0.00421	0.00093	0.00784

In table 12, the consistency between alpha estimates obtained through Newey-West and bootstrap BCa methods confirms the robustness of our findings. By addressing potential issues such as autocorrelation, heteroscedasticity, and non-normality, these methods provide complementary perspectives that reinforce the reliability of the reported alpha. The overlapping confidence intervals across both approaches strengthen our confidence in the statistical significance of SIN's abnormal returns.

Table 13: Comparison of ALPHA Estimates: Newey-West vs. Quantile Regression in the Five-Factor Model for SIN portfolio (1965-2023, value-weighted)

This table compares the ALPHA (intercept) estimates and their 99% confidence intervals obtained using Newey-West regression and quantile regression at the 25%, 50%, and 75% quantiles. ALPHA represents the abnormal return of the SIN portfolio under Fama-French Five-Factor model. The Newey-West method provides robust standard errors to address heteroscedasticity and autocorrelation, while quantile regression evaluates the relationship across different points of the return distribution. Confidence intervals are calculated to assess the precision of the estimates.

Method	Alpha Estimate	Lower Bound	Upper Bound
Newey-West	0.00421	0.00089	0.00754
Quantile (25%)	-0.01555	-0.01966	-0.01145
Quantile (50%)	0.00519	0.00112	0.00926
Quantile (75%)	0.02445	0.02044	0.02847

In table 13, quantile regression tests the robustness of SIN's alpha across different points of the return distribution (25th, 50th, and 75th quantiles). This approach ensures that the abnormal returns are not driven solely by extreme observations or average conditions but are consistent across different market environments. The finding that alpha remains significant across all quantiles strengthens the reliability of our results, demonstrating that SIN stocks deliver abnormal returns regardless of market performance. The absence of zero in the confidence intervals further confirms the robustness of these excess returns.

5. Conclusion

In this study, we show that the Fama-French five-factor model, including the profitability (RMW) and investment (CMA) factors, does not necessarily make the alpha of sin stocks disappear over the period 1965-2023. Our results indicate that sin stocks in the alcohol, tobacco and gambling industries generate positive abnormal returns, even after accounting for established risk factors. This suggests that the factors driving the sin premium are not fully captured by the FF5 model. Additional elements, such as systematic neglect or exclusion based on social norms may play a role in sustaining this premium.

Over the period 2007-2023, characterized by increased exclusionary screening and market efficiency, sin stocks continued to deliver positive risk adjusted abnormal returns. We find that the excess sin portfolio generates monthly positive abnormal returns of 47 bps, or 5.64% annually over the period 2007-2023. This has economic significance and points toward a trade-off between sustainable investing strategies and financial gains. Investors excluding sin stocks may forgo potential abnormal returns. Sin stocks may continue to be underpriced due to limited risk sharing stemming from social norms, leading to higher expected returns as compensation. During this time, our results show that only the alcohol industry exhibits a positive significant alpha under the FF5 model.

However, we cannot conclusively say that over the period 1965-2023, sin stocks outperform their comparable stocks due to issues of random noise identified in the placebo test. This finding shows that the sin stock classification and its associated premium may be inherently incorrect. Future research could further explore the robustness of the sin classification to validate the implications more conclusively.

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Appendix

Table 14: Yearly COMPS Stock Counts by Industry with Unique Totals

This table displays the yearly distribution of sin stocks across the Food, Soda, Fun and Meals & Hotels industries from 1965 to 2023. The counts represent unique stocks classified per year within each industry. The 'Total' column aggregates the number of sin stocks across all industries for each year. The 'Total' row at the bottom represents the unique stock counts over the full period (1965–2023).

Year	Food	Soda	Fun	Meals & Hotels	Total	Year	Food	Soda	Fun	Meals & Hotels	Total
1965	84	16	27	29	156	1995	100	13	96	170	379
1966	81	16	28	28	153	1996	102	12	104	195	413
1967	77	16	26	26	145	1997	105	12	106	194	417
1968	77	17	24	27	145	1998	107	13	98	188	406
1969	74	13	23	31	141	1999	100	13	83	165	361
1970	79	13	23	37	152	2000	98	13	77	144	332
1971	80	12	25	39	156	2001	93	15	61	141	310
1972	127	27	50	95	299	2002	76	15	40	115	246
1973	129	28	53	97	307	2003	75	16	36	105	232
1974	118	27	44	89	278	2004	69	16	36	105	226
1975	114	27	38	82	261	2005	73	17	36	97	223
1976	113	27	40	85	265	2006	68	21	39	97	225
1977	110	26	39	83	258	2007	62	20	37	83	202
1978	106	25	42	77	250	2008	57	21	37	73	188
1979	98	21	36	76	231	2009	58	19	37	71	185
1980	91	17	39	77	224	2010	56	19	32	68	175
1981	90	15	46	92	243	2011	56	17	29	62	164
1982	86	12	47	98	243	2012	52	10	24	59	145
1983	83	11	51	127	272	2013	52	11	23	52	138
1984	87	10	67	138	302	2014	49	10	23	57	139
1985	89	9	76	143	317	2015	49	10	23	57	139
1986	103	11	101	156	371	2016	49	10	21	55	135
1987	105	9	93	148	355	2017	45	12	17	55	129
1988	109	11	93	138	351	2018	38	12	17	52	119
1989	101	10	99	122	332	2019	35	11	18	49	113
1990	98	10	95	117	320	2020	39	11	17	47	114
1991	98	10	92	118	318	2021	39	12	17	46	114
1992	97	10	89	129	325	2022	39	12	14	44	109
1993	98	12	88	138	336	2023	40	12	16	46	114
1994	99	11	100	154	364	**Total**	**391**	**65**	**402**	**535**	**1393**

Table 14 displays the yearly distribution of COMPS stocks classified across the Food, Soda, Fun, and Meals & Hotels industries from 1965 to 2023. The total number of unique stocks across all industries is 1,393 (which deviates slightly from the true number of unique stocks due to some industry-reclassifications). The table highlights the consistent presence of Food and Soda stocks over time, while the representation of Fun and Meals & Hotels industries fluctuates. The inclusion of many stocks across comparable industries enhances the robustness of the control portfolio, ensuring a diverse comparison against sin stocks.

Table 15: Replication Summary Statistics (Equal-Weighted Returns for SINR and COMPSEW Portfolios, 1965-2006)

This table summarizes the equal-weighted monthly returns for the SINR and COMPSEW portfolios, along with market factors, for the replication period 1965–2006. SINR represents the equal-weighted sin stock portfolio as defined in Hong and Kacperczyk (2009), obtained from Marcin Kacperczyk's page on NYU Stern's website. SINR-COMPSEW is an equal-weighted long-short portfolio that is long on sin stocks (SINR) and short on comparable non-sin stocks (COMPSEW). SINR and COMPSEW are presented as their excess returns over the risk-free rate (RF). MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers.

Variable	Mean	Median	Min	Max	N	SD
SINR-COMPSEW (%)	0.29	0.11	-8.59	12.20	504	2.56
SINR (%)	0.98	0.79	-26.84	31.92	504	5.61
COMPSEW (%)	0.69	0.84	-27.90	29.06	504	5.48
MKTPREM (%)	0.46	0.73	-23.24	16.10	504	4.47
SMB (%)	0.26	0.14	-17.20	21.36	504	3.29
HML (%)	0.47	0.46	-9.87	12.47	504	2.85
MOM (%)	0.83	0.88	-25.30	18.20	504	4.07

The replication of Hong and Kacperczyk's (2009) study yields comparable descriptive statistics, underscoring the robustness of the original findings within the replication period (1965–2006). Specifically, the mean and standard deviation of SINR-COMPSEW (equivalent to EXCOMP) and SINR (equivalent to EXSINP) align closely with their reported values, supporting the validity of the replicated portfolio construction and methodology. For instance, the mean return for SINR-COMPSEW (0.29%) is consistent with the 0.25% observed for EXCOMP, and the standard deviation (2.56%) closely mirrors the 2.57% reported in the original study. Similarly, SINR demonstrates a mean return of 0.98%, aligning with the 0.96% for EXSINP, with similar levels of volatility (5.61% vs. 5.62%).

Table 16: Regression Results for SINR-COMPSEW (1965-2006, Equal-weighted, Newey-West Standard Errors)

This table presents the regression results for the SINR-COMPS portfolio for the replication period 1965–2006, using equal-weighted returns. SINR-COMPS is an equal-weighted long-short portfolio that is long on sin stocks (SINR) and short on comparable non-sin stocks (COMPS). The regressions include the Capital Asset Pricing Model (CAPM), the Fama-French Three-Factor Model, and the Carhart Four-Factor Model. ALPHA represents the intercept (abnormal return) of the regression. MKTPREM is the excess monthly return of the value-weighted CRSP index. SMB is the return of a portfolio that is long on small stocks and short on large stocks. HML is the return of a portfolio that is long on high book-to-market stocks and short on low book-to-market stocks. MOM is the return of a portfolio that is long on past 12-month return winners and short on past 12-month return losers. The table reports coefficients with Newey-West standard errors in parentheses, alongside adjusted R^2 values and the number of observations (#obs.). Statistical significance is denoted by *** for 1%, ** for 5%, and * for 10%.

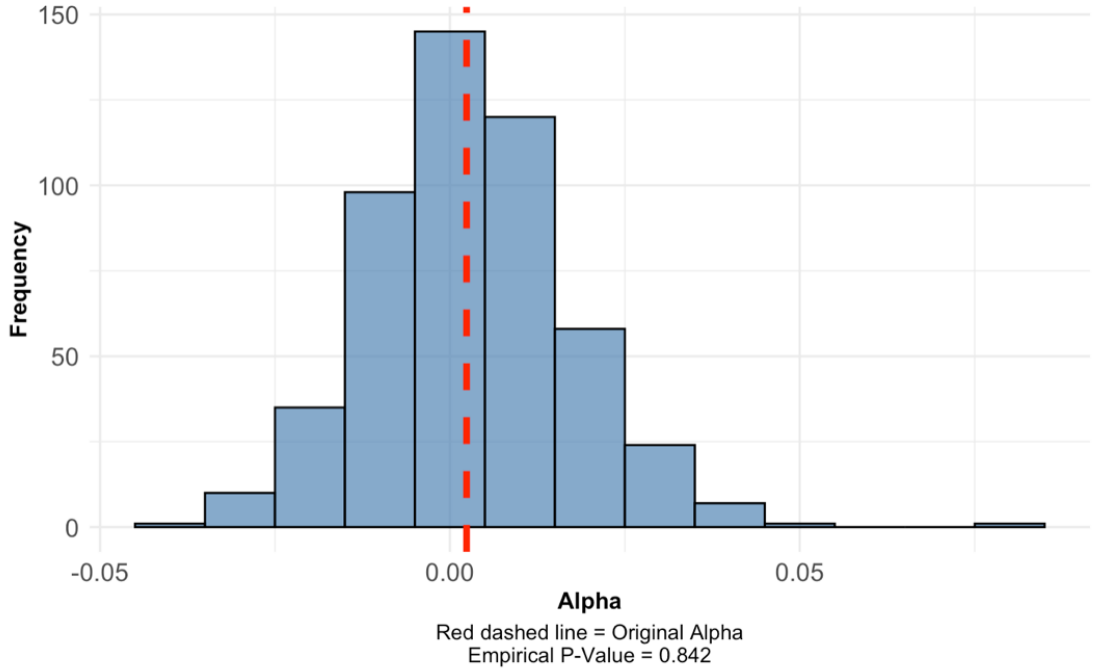
Variable	ALPHA	MKTPREM	SMB	HML	MOM	Adj.R^2	#obs.
SINR-COMPSEW	0.0030**	-0.0249				-0.0001	504
	(0.0013)	(0.0260)					
SINR-COMPSEW	0.0026**	0.0237	-0.1038***	0.1034**		0.0282	504
	(0.0012)	(0.0277)	(0.0357)	(0.0405)			
SINR-COMPSEW	0.0024*	0.0264	-0.1043***	0.1087**	0.0216	0.0274	504
	(0.0013)	(0.0304)	(0.0365)	(0.0429)	(0.0396)		

For ALPHA, under the CAPM model, Hong and Kacperczyk estimate a value of 0.0025 (standard error (SE): 0.0014), which is consistent with the replication result of 0.0030 (SE: 0.0013). Similarly, under the three-factor model, the original ALPHA of 0.0026 (SE: 0.0014) aligns closely with the replicated ALPHA of 0.0026 (SE: 0.0012). The four-factor ALPHA also shows consistency, with Hong and Kacperczyk reporting 0.0026 (SE: 0.0013), matching the replication value of 0.0024 (SE: 0.0013).

Figure 3: Carhart Placebo Test for SINREW-COMPSEW (1965-2006)

This figure illustrates the results of the placebo test for the SINR-COMPSEW portfolio (1965–2006) under the Carhart Four-Factor Model. SINR-COMPSEW represents an equal-weighted long-short portfolio that is long on sin stocks (SINREW) and short on comparable non-sin stocks (COMPSEW). The histogram shows the distribution of

alphas (intercepts) from 500 placebo tests, where sin stock labels were randomly assigned to non-sin stocks. The red dashed line indicates the original alpha from the actual regression, and the empirical p-value quantifies the probability of observing an alpha as extreme as the original alpha for SINEW-COMPSEW under random assignment.



The placebo test for the SINR-COMPSEW portfolio under the Carhart Four-Factor Model reveals that the observed alpha lies within the distribution generated from 500 random reassignments of sin stock labels to non-sin stocks, with an empirical p-value of 0.842. This suggests that the alpha could be influenced by noise. While COMPSEW is our own dataset, it is plausible that some degree of noise was present in Hong and Kacperczyk's original analysis, given the reliance on similar portfolio construction methods. However, it is important to note that Hong and Kacperczyk follow up their time-series regressions with cross-sectional regressions that include control variables, and these yield nearly identical results, strengthening the robustness of their conclusions despite potential noise in the time-series data.

AI Appendix

In writing the thesis we have used ChatGPT for grammar and spell checking the text. In addition, this AI-tool has assisted us when coding in R, specifically in solving issues and formatting tables.