



SCHOOL OF
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By Vice or Virtue: Does it Pay Off to Sin During Market Downturns?

A bachelor's thesis on sin stock recession resistance and portfolio
performance

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Abstract

This paper investigates sin stock characteristics through relative return performance compared to the global market index MSCI World, defining stock defensiveness towards market movements (i.e. recession resistance) and abnormal amounts of excess returns. This was achieved by constructing a sin stock portfolio; SINDEX, containing stocks from the alcohol, tobacco, gambling, weapons and defence, fossil fuels and cannabis industries. For comparison, two additional portfolios were constructed, one consisting of SRI stock comparables; SRINDEX, the other consisting of "the most ethical companies" based on Ethisphere's list of honorees; SAINTDEX. Using five conventional capital asset pricing models in addition to the betting against beta factor, the characteristics of each portfolio is studied. Each model is estimated during the sample period between 1986 and 2021, as well as during five three-year recession periods.

We find evidence that sin stocks provide both recession resistant and superior returns compared to the market. Majority of the time, sin industry sub-portfolios also provide superior returns over the market. However, sin stocks are found to underperform compared to their more virtuous and socially responsible alternatives when adjusting for assumed risk. Potentially reflecting a change in current investment attitude and behaviour.

Keywords: *Sin stocks, socially responsible investing, recession resistance, alpha, beta*

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Terminology

This section discloses and explains all terms and abbreviations utilized in this paper.

- SINDEX:** Denotes this study’s constructed sin stocks portfolio.
- SRINDEX:** Denotes this study’s constructed SRI stocks portfolio.
- SAINTDEX:** Denotes this study’s constructed “most ethical” stocks portfolio.
- SMB:** The size premium factor, also known as the “Small Minus Big” factor. Denotes the historic excess return of small-cap companies over the large-cap companies.
- HML:** The value premium factor, also known as the “High Minus Low” factor. Denotes the historic excess return of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio).
- MOM:** The momentum factor. Denotes the average returns of winning over losing companies.
- RMW:** The profitability factor. Denotes historic excess return of the most profitable companies over the least profitable companies.
- CMA:** The investment factor. Denotes historic excess return of conservatively investing companies over aggressively investing companies.
- BAB:** The betting against beta factor.
- CAPM:** Capital Asset Pricing Model.
- FF3:** Fama and French Three-factor Model.
- C4:** Carhart Four-factor Model.
- FF5:** Fama and French Five-factor Model.

1. Introduction

1.1 Introduction

In the cult classic comedy *Thank you for smoking* by director Jason Reitman (2005), J.K. Simmons' character “BR”, delivers quite a brash yet poignant scolding to his fellow employees:

”People, what is going on out there? I look down this table, all I see are white flags. Our numbers are down all across the board. Teen smoking, our bread and butter, is falling like a shit from heaven! We don't sell Tic Tacs for Christ's sake. We sell cigarettes. And they're cool and available and addictive. The job is almost done for us!”

You'll most likely be hard-pressed to find a more blatant line of text describing what makes cigarettes an incredibly lucrative product to sell. However, it also implies the exact premise that the rest of the film wants to convey; distribution and marketing of cigarettes is generally perceived as a sin in the eyes of the public. After many concerning health-related findings and lengthy legal battles with “big tobacco” during the latter parts of the 20th century, the World Health Organisation (WHO) introduced the Framework Convention on Tobacco Control (FCTC), effectively enforcing all membership states to display warning texts raising awareness against smoking on cigarette packages (FCTC, 2021). Understandably, this presented a problem for the profitability of the tobacco industry. However, nowadays it seems that the tobacco business is condemned in the public domain more due to its exploitative nature of an unhealthy human vice, rather than the directly associated health risks smoking imposes. As such, people seem to advocate neglect for unethical industries. Yet this very neglect is what some attribute to the abnormal profitability of stocks in the tobacco and other comparable sin industries for investors with a bit of moral flexibility (Hong & Kacperczyk, 2009).

In essence, equity trading is the act of buying and selling of company stocks (also known as equities) on the equity market (i.e. stock market). As such, investors take on the direct ownership of the underlying asset (i.e. the company). This means that if the value of the stock rises, the investor profits. Likewise, if the value of the stock falls, the investor takes a loss (CMC Markets, n.d.). Most (if not all) current business schools around the world teach students that the

main goal of an investor is to evaluate, trade and diversify their equities in a manner that nets them a financial profit. Without venturing outside the realm of legalities and insider trading, investors are conventionally believed to base their investment strategies on companies financial reports supported by evaluations of potential returns risks that supervene. However, this is a simplified generalization of the way people actually act within society. Much like any other decision, financial decisions are rarely made in a vacuum, but are often affected by cultural, ethical and societal norms. Studies to the likes of Salaber (2007), Fabozzi et al. (2008) and Hong & Kacperczyk (2009) have previously researched the role this kind of “intangible factors” (i.e. factors that cannot be expressed in monetary terms) play on today’s equity trading and the pricing of stocks. Sometimes the pricing of stocks don’t really reflect the actual financial performance of the underlying asset. This is often common amongst “speculative stocks” used for investor speculations, companies guilty of scandalous behaviour and “value stocks” which are believed to be traded at a lower price relative to its fundamentals (Chen, 2019; Smith, 2020). Based on the results of studies about investor behavior, it has evidently become more apparent that investors value more than just the financial potential of some equity assets. Instead we’ve seen a rise in interest for the moral implications of investments. Contrary to expectations, some researchers have found that morally questionable stocks seem to outperform their socially acceptable counterparts. This phenomenon has adequately been known as the “sin stock anomaly” (Blitz & Fabozzi, 2017). One of the pioneering studies within this subject of financial economics, Hong and Kacperczyk (2009), hypothesized that this stemmed from the pressure of societal norms which in turn led to neglect from private and institutional investors as well as less analyst coverage. Which in turn would result in being undervalued and therefore be misinterpreted to outperform comparable stocks due to skewed expectations of returns. If this in fact is the case, it would indicate that market behaviour and outcomes are dependent on societal norms and sometimes might even supersede financial profit motives (Hong & Kacperczyk, 2009).

1.2 Research Purpose

This study will conduct a comparative analysis on the portfolio performance of sin stocks in relation to the market; in the form of the global index MSCI World, and their socially acceptable counterparts; SRI stocks. Through regression analysis, this study aims to establish which investment strategy is more recession resistant, while also being able to identify if there exists any general yield discrepancies between the two aforementioned investment strategies. Furthermore, recessionary (crisis) and industry-specific regressions are conducted in order to establish portfolio performance prior and in the midst of market downturns, as well as which sin industry generated the largest return during the selected time period and observe which sin stocks carry the bulk of the potential abnormal returns in the sin portfolio. In doing so, this study hopes to contribute to existing literature regarding the sin stock anomaly and portfolio performance by utilizing new and more current capital asset pricing concepts; Fama and French Five-factor Model in addition to the betting against beta factor.

This study adds to previous literature by introducing and analyzing both cannabis stocks and fossil fuel stocks within the classification of a sin portfolio. To our knowledge, no previous or unpublished papers have included these two categories in any empirical studies regarding the performance of sin stocks. Additionally, the sample period chosen for this study includes five major market downturn periods, and would be the first to include the COVID-19 recession, as seen in Table 1.

As such, the questions at issue for this study is as follows:

Q1: *Does it pay off to invest in sinful stocks during market downturns?*

&

Q2: *Is sinful investing more defensive than other investment strategies?*

Table 1 Summary of previously conducted studies on performance of sin stocks													
Study	Market	Sample period	Models	Sin stock sample size	Industries							Result	
					Alcohol	Defence & weapons	Gambling	Fossil fuels	Tobacco	Cannabis	Others		
Salaber (2007)	18 European markets	1975-2006	CAPM & FF3	158	x	x	x	-	x	-	-	-	Positive but insignificant
Fabozzi et al. (2008)	21 markets	1970-2007	CAPM	267	x	x	x	-	x	-	x	-	Positive and significant
Hong and Kacperczyk (2009)	US	1926-2006	CAPM, FF3 & C4	184	x	-	x	-	x	-	-	-	Positive and significant
Ozkan and Xiong (2009)	US	1980-2008	CAPM & FF3	37	x	x	x	-	x	-	x	-	Negative but insignificant
Salaber (2009)	US	1926-2005	C4	183	x	-	x	-	x	-	-	-	Positive and significant
Jo et al. (2010)	US	1990-2009	-	-	-	-	-	-	-	-	-	-	Positive but undefined
Kim and Venkatachalam (2011)	-	1988-2006	ERC	117	x	-	x	-	x	-	x	-	Positive but insignificant
Bolneset and Storm (2013)	Global	1980-2011	CAPM, FF3, C4 & LIQ	248	x	x	x	-	x	-	-	-	Positive and significant
Troberg (2016)	18 European markets	1985-2015	CAPM & FF3	149	x	x	x	-	x	-	-	-	Positive and significant
Lobe and Walkshäusl (2016)	51 markets	1995-2007	CAPM, FF3 & C4	755	x	x	x	-	x	-	x	-	Positive but insignificant
Blitz and Fabozzi (2017)	US, Europe, Japan, Global	1963-2016	CAPM, FF3, C4, BAB & FF5	-	x	x	x	-	x	-	-	-	Positive but insignificant
This study	Global	1986-2021	CAPM, FF3, C4, BAB & FF5	291	x	x	x	x	x	x	x	-	Positive and significant

This table reports a summary of all previously published literature on the topic of sin stock performance. Complete with author names, markets investigated, sample time period, capital asset pricing models used, sample size, sin industries and final results.

1.3 Background

1.3.1 The Inelastic Nature of Sin Stocks

According to *Thank you for smoking* (2005), one major benefit of cigarettes is that they have addictive properties. More or less, it is what makes the customers come back for more products, despite the harm that it may inflict on their health. This is also true for most other sin products (e.g. gambling and alcohol). Addictive products such as these tend to have relatively inelastic demand curves, as there exists few (if any) satisfying alternatives. This in turn means that a change in income or price rarely has a significant impact on the demand of said product (Hall, 2020). For example, if someone were to lose their income or the product price increases, they would most likely not significantly reduce their consumption of cigarettes or alcohol, in some instances might even increase, whilst other elastic expenses such as clothes shopping would most likely take a decline instead. This is consistent with the findings of Tobacco in Australia (2021), who estimated that a ten percent increase in price would only reduce cigarette consumption by approximately four percent. Additionally, in some cases, consumers' dependency on sin products aren't just mental, as it can also become physical (Felman, 2018). Which in turns the 'want' to consume a certain product into an actual physical 'need'.

The connection between dependency and inelasticity indicates that sin products such as cigarettes aren't especially dependent on individuals' financial situations, which in turn may give sin a certain "recession proof" quality. The reasoning for this assumption is that consumption of sinful products as a whole wouldn't see significant decrease in sales during market downturns, as a direct result of their inelastic nature. It is no surprise that some people resort to often unwanted desires when things go badly. According to Popovici and French (2013), there is a clear and significant connection between alcohol consumption and unemployment rate. However, one interesting finding was done by Frone (2016), who found that alcohol consumption during The Great Recession did not just increase amongst the unemployed, but also amongst those still employed. Which in turn could indicate a certain desire for escapism amongst individuals across the board during certain bad market periods.

Overall, with this certain unique inelastic nature of sinful products, the stocks of the sin companies behind them should theoretically not be affected as much as other comparable

industries during market downturns. This in turn would also likely make sin stocks a viable option for ethically flexible investors who wish to hedge against recessionary periods.

1.3.2 The Evolution of Sin

“The only constant in life is change”

- Heraclitus

It is empirically obvious that notions change over time, between societies and even from one individual to another, for an immeasurable amount of reasons. This is of course also true for our perception of morality and sin. Products that once were perceived as sinful can undergo change over time. One such area of products that has gotten generally more socially accepted, at least in North America, are cannabis products. During the 1930s depression, attitudes towards Mexican immigrants and Afro Americans were generally getting more racist, which seems to be a trend for when times get increasingly worrisome. Since cannabis was heavily associated with these communities of people, with the Afro American jazz musician Cab Calloway even creating the song *Reefer Man* (1932), it started to get demonized within mainstream media (McNearney, 2020). Further fueling the public fear of cannabis, the propaganda movie *Reefer Madness* (1936) saw American high school students test cannabis, which in turn led them into a downward spiral of accidents, rape and even murder (Frontline, n.d.). That same year, The Motion Pictures Association of America, which at the time was made up of several large Hollywood studios, banned the use of narcotics in films as part of their Motion Picture Production Code (Margaret Herrick Library, n.d.). With cannabis rapidly gaining a more sinful public image, the following years saw several legislations being passed. By the 1950s, marijuana possession had a minimum sentence of two to ten years in prison. All this happened despite the fact that the New York Academy of Medicine in 1944 had claimed marijuana did not lead to insanity nor violent behavior, which had been propagated in the media at the time (Frontline, n.d.).

However, a lot has changed since then. Cannabis has now become legalized in sixteen states and there are even publicly traded cannabis stocks in both Canada and America (Berke et al., 2021). According to Pew Research, about two thirds of Americans support the legalization of cannabis, which is a change that has come about during the last ten years (Daniller, 2019). It is

then clear that the public view of some products or industries can be mended over time. However, time has shown to also have the inverse effect. During the 1960s, the public image of tobacco took a dramatic decrease, after years of notable increase in sales over the first half of the 20th century (Cummings & Proctor, 2014). The previous decade saw the release of Reader's Digest's now infamous article "Cancer by the Carton" (1952), which then got amplified by reports like The Surgeon General's Advisory Committee (1964) who concluded that smoking imposed notable health hazards for the user (Ruble, 2014). As a result, tobacco consumption decreased and the public image was forever changed and tainted.

The historical change in the perception of tobacco due to societal norms or other findings exemplify a pattern which seems to have spread to other current industry sectors, more specifically the fossil fuel industry. In recent years, the question of global warming has become a hotly debated topic. Millions of people even started protesting through strikes from school and work during 2019, inspired by the initial actions of the famous young climate change activist Greta Thunberg (Taylor et al., 2019). Fossil fuels are now generally depicted as outdated and harmful while alternative and renewable energy gets praised by the public. As a result, it has become more frowned upon to invest in further developments within the fossil fuels industry, similar to what happened with the tobacco industry. As such, this could indicate some sort of parallel or shared aspect between fossil fuels and other sin industries.

1.3.3 Industry-specific Risks of Sin Companies

Due to often being the subject of public scrutiny, sin companies carry certain industry specific risks. One of these being the increased probability of negative publicity, otherwise known as Headline risk (Fabozzi, 2008). The negative connotation surrounding sinful products often create negative light and judgment falling upon the sin companies. Which is further proven by all the anti-smoking propaganda spread through articles with condemning headlines such as Reader's Digest's "Cancer by the Carton" (1952) and Chicago Tribune's "Tie Cancer to Cigarettes" (1964), which are highly likely to impact sales and investment frequencies for the companies involved.

An additional risk associated with sin companies is that they are often at the mercy of policy changes or other legislation decisions that may come into effect down the line. This may include something as small as a tax change or requirements for warning labels to larger scale

changes like a complete ban on sales of a certain product within national markets or the global market as a whole. This is often referred to as Disaster risk, which may severely damage or even obliterate a business. However, though the probability of occurrence for these catastrophes often are miniscule, the reality of its existence may very well dismay some investors and the overall valuation of the affected stocks, subsequently leading to stock undervaluations. In the majority of cases, a Disaster risk is often associated with natural disasters (UNDRR, n.d.). But for sin companies, a complete sales ban is very much a possibility and will most likely lead to their imminent bankruptcy. Furthermore, disaster risk may lead to higher returns in order to compensate for the risk investors assume, which can often be perceived as abnormal returns when viewed through conventional capital asset pricing models.

Finally, sin companies carry a high Litigation risk, meaning that there is a risk of costly legal actions may be taken against them (Kenton, 2020). With some sin companies producing directly harmful products, the risk of being sued is significantly higher than any comparable non-sin companies. This doesn't only present a financial cost for the affected companies, but also affects investment frequency and stock valuation.

As emphasized by this introduction, sin industries are unique in many aspects. Not only through the products that they produce, but also the certain vulnerabilities they unwillingly inherit. However, before further discussion of prior studies, our data, methods and analysis, there is a need to review the definition of sin. This is not only important in order to understand the contents of this study, but also due to the fact that differences in conclusions amongst previous literature can to some extent be traced back to differences in the definition of each investment strategy.

1.4 Defining Vice and Virtue

1.4.1 Sin Stocks

Defining sin stocks is quite critical due to the fact that various industries and sectors have been included under this informal label. The most generally accepted definition of sin stocks is that they refer to equity in firms involved in the production and distribution of products and services deemed unethical, immoral or sinful. However, the notion of sin has its roots in societal norms and religious environment, which may differ greatly between time period and communities. As

such, which industries that are considered sin stocks may vary depending on investor-specific effects for each respective investor: such as age, personal beliefs and ethical flexibility.

Even though there may be very little capacity of establishing a concrete definition of each included industry, a frequently used definition is the so-called “Triumvirate of Sin”. This classifies sin stocks as those found in the alcohol industry (i.e. companies that produce and sell beer, cider, wine and spirits), tobacco industry (i.e. companies that produce and sell cigarettes and cigars) and gambling industries (i.e. companies that offer gambling services, such as casinos). Although these are generally considered as the “big three”, *Sin Stock Report* identifies additional sub-categories as the weapons and defence industry, the sex and porn industry and the cannabis industry. Some studies such as Fabozzi et al. (2008) have also identified biotech as a sin industry based on some investors’ moral and religious views within the debated sphere of pro-life and pro-choice. Primarily because biotechnical companies can often produce products related to abortions, birth control and genetic alterations (Fabozzi et al., 2008). Furthermore, the recent rise in public concern for climate change and renewable energy has led us to raise the question whether the fossil fuels industry should be considered a sin industry or shows similar development symptoms as others ‘now to be considered’ sin industries (e.g. tobacco industry).

Ultimately, this study will include alcohol, tobacco, gambling, weapons and defence, fossil fuels and cannabis industry under the definition of sin stocks.

1.4.2 Socially Responsible Investments

Socially Responsible Investing, or SRI in short, is believed by many to be the opposite of sin stocks. This investment strategy aims to both encourage social change and uphold societal norms while still generating financial profits for the investor. In order to find which stocks are to be considered “investable” within this restricted stock universe, investors can utilize different kinds of screening methods (e.g. negative and positive screening).

Negative screening is when stocks are excluded from investment consideration on the basis that the company is engaged in undesirable activities or industries. This may include industries such as tobacco, alcohol and other sin industries, but may also include other excluding criterias not related to sin stocks. Positive screening, also known as best-in-class screening, is when filtered stocks are ranked based on their recorded ability to advocate and uphold certain social responsibilities in areas such as environment, employee relations or diversity. As such,

positive screening allows investors to compare desirable companies to their peers based on their ranking and establish a hierarchy of the ‘most desirable’ investments within their restricted stock universe (Schyndel, 2021).

A few years back, negative screening was the first choice. However, according to the results of a report published by Edhec-Risk Institute in 2020, about 45 percent of investor respondents favoured positive screening in contrast to only 25 percent who still favoured negative screening (Sourd & Martellini, 2020). Overall, SRI investors have started to rely more on positive screening which might be due to better data and long-term performance, but could also be attributed to the development of ESG (Boyde, 2020).

ESG is in many ways an evolution of interests shared by socially responsible investors alike and is nowadays often used synonymously with sustainable and socially responsible investing. ESG is short for “Environment, Social and Governance” and presents a way for investors to introduce non-financial factors such as societal norms and personal values, as part of their analysis process to identify desirable investment opportunities. However, it differs itself a bit from traditional SRI methods. The ESG rating (i.e. ESG metric) looks at finding existing value in companies rather than supporting a set of values (MSCI, n.d.).

For the purpose of this study having representative results in the current state of finance, we’ve chosen to utilize the more advanced and recent ESG selection process when defining socially acceptable comparable stocks.

1.5 Crisis Periods

This section is dedicated to introducing and summarizing the events and economical effects of each selected crisis period for the purposes of this study.

1.5.1 Crisis Period I (Black Monday)

The 80s was a turbulent period for business. The US hit a recession, global trade was on the downturn after decades of thriving with new reforms and removal of post world war tariffs (Ekonomifakta, 2020). This was until the 19th October 1987, when “Black Monday” hit. In just the five years prior, the Dow Jones Industrial Average (DJIA) had tripled in value (Hayes, 2020).

But when the date struck, DJIA dropped 22 percent in a single day, and by the end of the month, most major exchanges had fallen by 20 percent.

1.5.2 Crisis Period II (The Gulf War Recession)

The following chosen crisis dates between July 1990 and March 1991, being the result of Iran invading Kuwait, also known as the Gulf War. Amongst the results of this crisis, the world saw spiking oil prices (Investopedia, 2021). Other factors such as a credit crunch, debt accumulations from the 80s and the Federal Reserve trying to lower the US' inflation rate, have all been cited as contributing components of this recession (Walsh, 1993).

1.5.3 Crisis Period III (The Dotcom Bubble Collapse & 9/11 Attacks)

At around the turn of the millenium, a lot of speculative investments were made in tech companies in hopes for the new economy that would follow. This in turn led to a bubble causing a massive market downturn (Hayes, 2019). In the last five years before the turn of the millennium, the Nasdaq Index rose five-folds, eventually resulting in a 77 percent collapse in 2001. As if that wasn't enough, the infamous terror attack "9/11" also occurred shortly after, closing several stock markets for multiple days, causing a notable downturn once reopened. Dow Jones Industrial Average alone dropped by 7.1 percent (Amadeo, 2021).

1.5.4 Crisis Period IV (The Great Recession)

The subprime mortgage crisis was the worst economic downturn since the Great Depression in 1929 and was caused by mortgage backed securities based on risky home loans. In the years prior, innovations in the mortgage industry made it possible for banks to lend money to borrowers otherwise not qualified for lofty home loans. Combined with overrated credit scores, this resulted in rapid declines for the entire mortgage industry once loans started to default (Investopedia. 2020).

1.5.5 Crisis Period V (COVID-19 Recession)

Last and most recent, a global market downturn occurred during March 2020 due to the then uncontrolled spread of COVID-19 which had just been classified as a pandemic by the World

Health Organization (2020). Travelling was restricted and non-essential businesses were closed to contain the spread. As such, some businesses took on massive losses, while others went bankrupt due to choked revenue sources. As of June 8th 2020, the National Bureau of Economic Research officially declared it a recession.

1.6 Literature Review

This section is dedicated to the introduction of existing literature on the performance of sin stocks, upon which this study hopes to build and further contribute to.

Salaber (2007) investigated 18 European markets between 1975 and 2006 in order to find whether country-specific effects (e.g. legal and cultural environment) influences the return of sin stocks. The markets were chosen due to two stated main denominators; 1) these countries are mainly Christians and 2) both Catholics and Protestants were represented. The results showed that sin stocks seem to outperform other stocks due to “sin aversion”. Furthermore, the study found that sin stocks within the alcohol and tobacco industry showed significantly higher risk-adjusted returns in markets with high excise taxation. As such, the study concluded that sin stock returns showed some degree of dependency on both legislation and the religious environment.

Fabozzi et al. (2008) approached the analysis of sin stocks through the perspective of how social values affect economical values. By conducting a study on 21 developed markets between 1970-2007 and expanding the Triumvirate of Sin with additional sin industries (e.g. defence, biotech and adult entertainment), they found that their constructed sin portfolio outperformed the average annual market return with 11.15 percent. Furthermore, the sin portfolio also outperformed the relevant market index in 35 of 37 years, indicating superior risk-adjusted performance in both magnitude and frequency. Consequently, the paper identified several reasons for this performance anomaly. The main one being due to the corporate financial gain of not conforming to or upholding costly implicit or explicit social standards. A secondary stated reason was due to sin stocks being undervalued compared to other stocks. However, it was acknowledged that Salaber (2007) concluded that sin stocks were in fact not undervalued.

Perhaps the most frequently cited study on the subject of sin stock performance to this date, Hong and Kacperczyk (2009), continued the research of investments in the Triumvirate of Sin by analysing the US market between 1926 and 2006 with respect to society’s framework of

morals, traditions and laws. Consequently, finding that sin stocks get lower institutional ownership and analyst coverage due to being readily exposed to public scrutiny and the existence of social norms against the funding of sinful operations. Furthermore, they find that sin stocks behave much like value stocks and notably outperformed the market, suggesting that sin stocks are both neglected and undervalued. As such, the paper concluded that the analysis showed proof for social norms having significant impact on the investing environment while also highlighting the corporate costs associated with conforming to social norms and the price for investors of adhering to a norm-constrained investment strategy.

To our knowledge, Ozkan and Xiong (2009) were the first to investigate sin stock performance with focus on recession periods. By analyzing the performance of their constructed hypothetical sin stock portfolio in relation to the market index S&P 500 between 1980 and 2008, they found that sin stocks had a defensive market relationship with a beta-value smaller than one. Furthermore, consistent with previous research, they also found that sin stocks behaved much like value stocks. As such, they concluded that investors could not only defend themselves during recession periods, but also generate superior returns by investing in sin stocks.

Salaber (2009) expanded upon her previous research in Salaber (2007) by analyzing the performance of sin stocks within the Triumvirate of Sin relative to defined industry-comparable stocks on the US market between 1926 and 2005. Results showed that sin stocks still earned abnormal risk-adjusted returns compared to the market. However, this abnormal return disappeared when comparing sin stock returns with industry-comparable stocks. Furthermore, sin stocks showed abnormal returns during recession periods, but underperformed during growth periods. As such, the paper concluded that previous beliefs of ‘sin stocks being defensive in nature’ remain valid but that this hedge against market downturn isn’t exclusive to sin stocks and could be achieved through other defensive stocks.

Moreover, Jo et al. (2010) flipped the focus onto SRI by examining the annualized return performance of a SRI index fund (MSCI KLD 400) relative to the market index S&P 500 and the Vitrium Global Fund (formerly known as the Vice Fund) on the US market between 1990 and 2009. Consistent with previous literature, results showed historically higher risk-adjusted returns for sin based investments than SRI based investments over the long term. However, over the most recent short term of one year, they found opposite results. As such, the paper concluded that the abnormal return of sin stocks may be due to the neglected stocks effect by Merton (1987) or

social norms. Subsequently, meaning that US investors pay the price of reduced returns when utilizing a SRI based investment strategy, due to reduced profitability and limited capacity for diversification.

Kim and Venkatachalam (2011) explored the impacts of social neglect and business risk on the quality of financial reporting amongst sin stocks. This was achieved by examining three measures of financial reporting between 1988 and 2006. Contrary to their hypothesis, the results revealed a higher quality of financial reporting amongst sin firms which could be attributed to sin firms wanting to attract a wider investment and analyst base. Consequently, this means that the higher risk-adjusted returns of sin stocks can't be explained by a lack of quality in financial reporting. Additionally, the paper argued that investors are willing to absorb a financial cost by complying with social responsibility, further proving the fact that non-financial factors such as social norms affect both investor's decision making and the performance of some stocks.

In their thesis, Bolneset and Storm (2013) examined the effect of social norms and morals on the global stock market between 1980 and 2011, through the perspective of Swedish societal norms. Like many prior, they constructed a hypothetical sin stock portfolio consisting of alcohol, tobacco, weapons and gambling stocks, which underwent regression analysis relative to the MSCI World index and constructed a saint portfolio control group. Much like previous studies, the results estimated significant abnormal risk-adjusted returns for the sin portfolio compared to ethically neutral investments. Additionally, three out of four sin industry sub-portfolios displayed significant alphas at a five percent level. As such, they concluded that sin stocks were sound investments during the sample period, and will continue to be in the near future, from a strictly financial perspective.

Troberg (2016) investigated the returns of sin stocks on European stock markets between 1985 and 2015 through a selection of alcohol, tobacco, gambling and defence stocks. By using traditional capital asset pricing models; CAPM and Fama and French Three-factor model in combination with cross-sectional regressions, she found statistically significant risk-adjusted abnormal returns associated with sin stocks. Hypothesizing this being the results of societal norm-driven investment strategies. As such, sin stock companies earn more due to investor neglect and as time passes and "awareness of ethics increases", sin stock companies will only continue to reign supreme with their abnormal returns. Furthermore, finding evidence for sin

stock recession defensiveness, with lower Beta values and a seemingly faster recovery rate from recessions.

Moreover, Lobe and Walkshäusl (2016) conducted an empirical study on 51 developed markets between 1995 and 2007, on what they defined as the “Sextet of Sin” (i.e. tobacco, alcohol, gambling, weapons, adult entertainment and nuclear power) to show if a constructed portfolio containing socially irresponsible firms trade at a discount. Lobe and Walkshäusl were not the first to expand beyond the horizons of the aforementioned Triumvirate of Sin. However, they were the first to define a new umbrella term for the inclusion of these additional sin industries. Three different sin indexes were constructed and compared to the performance of a set of important SRI indexes. While positive, the results exhibited no evidence for any significant differences in the performance of either set of indexes.

Most recently, Blitz and Fabozzi (2017) claimed to have solved the sin stock anomaly by conducting a fresh study on a constructed global portfolio containing alcohol, tobacco, gambling and weapons stocks between 1963 and 2016. But now being able to apply all the latest insights in asset pricing theory. Consistent with almost all previous literature, they find that sin stocks exhibit a significantly positive abnormal return when utilizing CAPM. However, when exposed to traditional asset pricing factors such as size and value, in addition to the recently introduced five-factor model by Fama and French, this abnormal return dissolves. Suggesting that the previously perceived abnormal returns of sin stocks can be fully explained when exposed to the five-factor model’s two new quality factors; profitability and investment, in combination with the betting against Beta factor. As such, the paper claims to have solved this return anomaly. However, note that even though they find no significant alpha-value, this doesn’t imply that exclusion policies (i.e. policies that don't allow investments in sin stocks) do not have any effect on the performance of some stocks. Furthermore, concluding that now when the source of performance loss is known for non-sin investors. They will now be able to restore their portfolio’s expected returns by controlling for exposure to these aforementioned quality factors.

1.7 Potential Research Limitations

There is no denying the fact that some unethical businesses including but not limited to - drugs, sex, weapons and ammunition, operate entirely on the black market and are very lucrative. However, due to obvious statistical constraints, this study is only able to observe and analyse their legal counterparts (i.e. if sin stocks yield any higher returns than those of socially responsible companies).

Furthermore, there are possible limitations associated with analyzing restricted datasets, such as a hypothetical portfolio, which may affect the external validity of our conclusion. The aim of this study is not to analyze the global stock market as a complete entity, but to provide and analyse a sufficiently large enough sample of stocks to support a generalized conclusion about the returns of opposing investment strategies during market downturns. However, as stated by Hong and Kacperczyk (2009), any findings regarding the effects of social norms in the stock market might possibly only represent the lower bounds of the reality, as many firms within sin industries might not go public due to this scrutinizing societal norms, legislations or other imposing factors.

2. Methodology

2.1 Data

2.1.1 Data Selection and Analysis

All data for this analysis were extracted from a combination of five sources; Bloomberg terminal, Thomson Reuters' Datastream, Eikon, Kenneth French's website and AQR's website. All data are on a monthly basis, which is consistent with all previously published studies. Additionally, Bloomberg, Datastream and Eikon are generally well-respected and trusted databases within the fields of finance. For the purposes of this study the time period 1986-01-01 and 2021-01-01, which is a total of 35 consecutive years of data that embodies five significant market downturns on both the US and global market. For this reason, no geographical restrictions were set on data collection, as the study aims to provide realistic results representative of the global stock market, not just a select few. This should in theory also reduce the risk of any country-specific risks or factors skewing the results in our analysis.

The Industry Classification Benchmark (ICB) was utilized in order to find relevant stocks for our selection. This classification system was introduced in 2006 by D&P Dow Jones and the FTSE Group (FTSE Russell, n.d.). Selection was then based preset selection criteria:

- The data can be retrieved from Thomson Reuters' Eikon and Bloomberg Terminal,
- A minimum of 50 percent of revenue has to be generated from the classified sector or subsector,
- The stock has to be traded on an internationally recognized stock exchange (i.e. non-OTC or grey markets),

The following description offers insight into all the different sin stock classifications based on the Industry Classification Benchmark:

Alcohol: The alcohol industry consists of two sub-sectors, brewers (i.e. manufacturers and shippers of cider and malt products such as beer) as well as distillers and vintners (i.e. Producers, distillers, vintners, blenders and shippers of wine and spirits such as whisky, rum or other liqueurs).

Tobacco: The tobacco industry includes manufacturers and distributors of cigarettes, cigars and other tobacco products. This also includes tobacco plantations. Additionally, this includes manufacturers and distributors of e-cigarettes and vaporizers.

Gambling: The gambling industry consists of providers of gambling and casino facilities (e.g. physical and online casinos, racetracks and manufacturers of casino and lottery equipment).

Weapons and Defence: The weapons and defence industry consists of both aerospace and defence stocks. This includes manufacturers, assemblers and distributors of aircrafts, as well as producers of equipment and components for the defence industry (e.g. weapons, military aircrafts and radar equipment).

Fossil Fuels: The fossil fuels industry consists of oil and gas producers, as well as producers of oil equipment, services and distribution stocks. This includes companies engaged in exploration, drilling and refining of oil and gas products, suppliers of equipment and services for oil fields or offshore platforms and operators of pipelines carrying oil, gas or other forms of fuel. Additionally, companies engaged in coal mining and or exploration for mining of coal are also included.

At the point of this study, there exists no singular classification code for the entire **cannabis** industry. As of January 2019, the ICB includes the sector “marijuana producers”. However, this only includes companies engaged in marijuana production. Including those involved in research, cultivation, processing and distribution of marijuana plants. This means that companies engaged in development and manufacturing of marijuana based drugs (THC/CBD) are found under biotech or pharmaceuticals. For this reason, our initial cannabis screening was complimented with lists from *Benzinga* and *Cannabis Stock Trades*. To confirm the accuracy of our selection, each asset is then cross-checked with the extended business descriptions and business status in Eikon.

The sex and porn industry was excluded due to limitations regarding data, as there are few publicly traded companies within this industry. Additionally biotech was excluded for the reason that we are not convinced that it should be considered a sin industry from a Swedish perspective.

Assets were first screened and selected through the Bloomberg terminal, then extracted from Datastream and manually cross-checked with Eikon’s more intuitive interface to ensure all preset qualification requirements were met and no unqualified assets were included in this analysis. Effectively eliminating any selection errors that may occur during the automated equity screening process. Additionally, any extreme outliers were eliminated in order to retain the

representative aspect and not skew the results of this analysis. As a result of this manual screening process, we were left with a grand total of 291 sin stocks between 1986-01-01 and 2021-01-01, which make up our hypothetical sin portfolio (SINDEX). This portfolio consists of six sin sub-portfolios representing each respective sin industry. In detail we were left with 57 stocks related to alcohol, 47 to tobacco, 56 to gambling, 37 to weapons and defence, 58 to fossil fuels and 36 to cannabis. For our counter selection, we constructed a portfolio of SRI comparable stocks with a (dynamic) requirement for reported ESG scores (SRINDEX) consisting of 266 companies, 30 in soft drinks, 58 in pharmaceuticals, 20 in recreational services, 63 in industrial engineering, 38 in renewable and alternative energy and 57 in agriculture. However, all selected stocks did not exist throughout the entire sample time period. As such, new stocks were added to their respective portfolio as they became active. Statistics for the amount of active stocks within each industry at the end of each year can be seen in Table 2, additionally the complete list of selected stocks can be seen in Table 10.

Table 2
Amount of active stocks compiled at the end of each respective year, by industry

Year	Alcohol	Tobacco	Gambling	Defence & weapons	Fossil fuels	Cannabis	Soft drinks	Pharmaceuticals	Recreational services	Industrial engineering	Renewable & alternative energy	Agriculture
1986	10	4	2	12	10	0	11	25	0	29	1	4
1987	10	5	2	12	10	0	11	26	0	29	1	6
1988	14	6	3	12	12	1	13	26	0	33	1	8
1989	16	6	4	12	13	2	14	29	0	34	1	9
1990	16	11	6	12	15	2	14	29	0	36	1	11
1991	17	11	7	12	15	2	14	32	0	37	2	12
1992	17	13	7	15	16	2	15	34	0	39	3	13
1993	17	15	12	15	17	2	16	36	0	40	3	15
1994	21	16	15	15	18	2	18	38	1	41	3	15
1995	23	18	18	16	18	3	18	39	2	42	4	15
1996	24	21	22	16	18	3	18	39	3	42	5	16
1997	28	21	22	17	19	3	19	40	4	43	5	20
1998	29	21	22	20	21	3	19	42	4	43	6	22
1999	31	23	23	20	21	3	19	42	4	45	7	23
2000	36	24	26	22	23	3	19	43	5	46	9	25
2001	37	24	28	22	23	3	20	44	6	49	10	28
2002	37	24	29	23	26	3	20	44	7	50	10	30
2003	39	24	29	24	27	3	20	45	7	50	11	31
2004	39	24	32	25	29	4	20	46	7	50	13	32
2005	39	26	39	26	35	4	21	48	8	51	15	32
2006	39	28	39	27	36	4	22	49	8	53	19	34
2007	39	29	42	27	37	9	23	50	9	55	24	40
2008	40	31	43	27	38	12	24	52	9	56	24	40
2009	44	33	45	27	38	12	24	52	9	57	25	42
2010	46	33	45	27	42	13	24	54	10	57	27	44
2011	46	34	46	27	46	16	24	54	10	58	28	45
2012	48	34	48	27	49	19	24	55	10	59	30	47
2013	48	35	48	27	49	19	26	56	12	60	33	47
2014	48	35	49	28	52	23	28	57	13	62	34	50
2015	49	37	50	31	52	27	28	57	15	62	35	51
2016	51	40	52	32	55	28	28	57	16	62	37	53
2017	52	40	52	32	57	28	28	57	17	62	37	55
2018	55	42	53	33	56	33	29	57	18	63	37	55
2019	57	46	56	35	57	34	29	58	19	63	37	56
2020	57	47	56	37	58	36	30	58	20	63	38	57

This table reports the amount of active stocks by the end of each year. Subsequently, also showing how many stocks each sub-portfolio contained at each point in time. The sum of all sin industries at each given time results in the amount of stocks contained in the sin stock portfolio at said time. Likewise, the sum of all SRI comparable industries at each given time results in the amount of stocks in the SRI stock portfolio at said time.

For additional comparison, we also chose to include a constructed hypothetical saint status portfolio (SAINTEX), consisting of 104 companies from Ethisphere's "2021 World's Most Ethical Companies" (Ethisphere, 2021).

Holdings for each aforementioned portfolio was value-weighted through the use of adjusted close prices and historical market caps. Portfolio returns are then constructed accordingly. Descriptive statistics for each portfolio and utilized input variable, for the entire sample time period, are presented in Table 3.

Table 3
Summary statistics for 1986-01-01 to 2021-01-01, by variable

	Mean	Standard Dev.	Kurtosis	Skewness	Variance	Minimum	Maximum
SINDEX	0.0089	0.0468	4.7398	-0.2484	0.0022	-0.1988	0.1746
SRINDEX	0.0104	0.0418	4.6850	-0.1512	0.0017	-0.1479	0.1863
SAINTDEX	0.0110	0.0489	4.8643	-0.3436	0.0024	-0.2113	0.1747
Rm-Rf	0.0042	0.0466	5.0297	-0.5605	0.0022	-0.1961	0.1451
Rf	0.0025	0.0021	1.9019	0.2751	0.0000	0.0000	0.0079
SMB	0.0007	0.0299	7.1257	0.3792	0.0009	-0.1489	0.1808
HML	0.0008	0.0298	5.8005	0.0916	0.0009	-0.1396	0.1258
MOM	0.0050	0.0458	13.8065	-1.4478	0.0021	-0.3439	0.1836
RMW	0.0033	0.0246	14.8354	-0.4326	0.0006	-0.1848	0.1338
CMA	0.0021	0.0200	5.2274	0.5247	0.0004	-0.0686	0.0956
BAB	0.0076	0.0294	5.7773	-0.4535	0.0009	-0.1245	0.1195

This table reports the summary statistics of all constructed portfolios as well as all of the included input variables utilized in the capital asset pricing models of this study.

The sample period is 1986-01-01 to 2021-01-01. SINDEX denotes excess returns of the constructed sin stock portfolio; SRINDEX denotes excess returns of the constructed SRI comparables portfolio; SAINTDEX denotes excess returns of the constructed most ethical portfolio; Rm-Rf denotes excess returns of MSCI World. SMB, HML, RMW and CMA denotes all four Fama and French input factors, taken from Ken French's website; MOM denotes the Carhart momentum factor; BAB denotes the betting against beta factor, taken from AQR's website.

2.1.2 Risk Free Rate

The risk free rate of return in this study is based on historical data for US one-month Treasury Bills. The US rate was chosen due to the global financial significance of the American stock market and was downloaded from Kenneth French's website (French, 2021). This rate should hopefully prove useful, as it was the used rate in all regression series developed by Fama & French and Carhart. However, we acknowledge the fact that the inclusion of more rates probably would reflect reality slightly better.

2.1.3 Beta as Recession Performance

Recession proof is often used to describe an asset that is believed to be immune to the effects of recessions (i.e. market downturns). Stocks with this characteristic are added to a portfolio in order to safeguard against or minimize the effects of economic declines, which may be triggered by a recession period. Although some assets are believed to be recession proof, very few (if any) are completely immune to economic downturns, as a long enough recession period can cause even the most resistant assets to fold (Chen, 2020).

In order to classify which assets are recession proof this study will utilize the Beta variable which can be found in all asset pricing models included in our portfolio analysis. Beta measures the market risk or volatility of the underlying asset or portfolio, which in turn indicates how much the price of the asset fluctuates compared to other comparable assets or relevant indexes (McClure, 2020; Kenton, 2021). Understanding the Beta will therefore be essential in order to interpret the results of this analysis. A negative Beta value is often believed to be a characteristic of recession proof assets, as it denotes an inverse relationship to the market (Chen, 2020). However, the probability of this analysis resulting in negative Beta values is less than 50 percent which would indicate a need to categorize every Beta value on the other end of the spectrum of potential results (i.e. Beta values larger than or equal to zero). As such, the following classification framework has been adopted for this study¹:

¹ This framework was constructed based on the different types of Beta values explained in the article "Beta" by *Investopedia* in addition to Sharpe (1964) in which clarification on the meaning of each included factor in the Capital Asset Model was given (Kenton, 2021; Sharpe, 1964).

Recession proof

$\beta < 0$ A negative Beta value indicates a negative market relationship and is therefore considered to be recession proof.

Recession resistant

$0 \leq \beta < 1.0$ A positive Beta value less than 1.0 indicates that the asset is in theory less volatile than the market and is therefore expected to be less affected than the market during a downturn.

Market equivalent

$\beta = 1.0$ A Beta value equal to 1.0 indicates a strong correlation to the market. However, this result is extremely unlikely for this study.

Recession sensitive

$\beta > 1.0$ A positive Beta value greater than 1.0 indicates that the asset is in theory more volatile than the market and is therefore expected to be more affected than the market during a downturn.

This framework rests conditionally on the assumption that symmetric market Beta values are true (i.e. the market Beta stays consistent and doesn't change depending on the market state).

2.1.4 Jensen's Alpha

As first introduced by mutual fund manager Michael Jensen (1968), Jensen's Alpha is a risk-adjusted performance measurement of the average return on an investment, above or below the expected return from the Capital Asset Model. Therefore, Jensen's Alpha will be used in this study to measure the abnormal return of our portfolios. In theoretically efficient markets, the expected value of Jensen's Alpha is zero (Downey, 2021). Thus, the Alpha value can judge the risk adjusted performance of a portfolio:

$\alpha < 0$ The asset has earned too little for the assumed risk.

$\alpha = 0$ The asset has produced adequate returns for the assumed risk.

$\alpha > 0$ The asset has earned an excess of returns for the assumed risk.

2.2 Portfolio Analysis Models

The following section is dedicated to introducing and explaining the different models this study will utilize in order to provide a thorough analysis on the performance of our portfolios. For all intents and purposes of this study, we utilize a confidence level threshold of at least 5%.

2.2.1 Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model was first developed and introduced by Jack Treynor (1962), William F. Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) based on the idea that not all risks should affect asset pricing.

$$ER_{i,t} = R_f + \beta * (R_{m,t} - R_{f,t}) + \alpha_{i,t}$$

$$R_{f,t} = \text{Risk free rate of return at time } t$$

$$R_{m,t} = \text{Market rate of return at time } t$$

$$(R_{m,t} - R_{f,t}) = \text{Risk premium of investment } i \text{ at time } t$$

$$\beta_1 = \text{Beta of investment}$$

$$ER_{i,t} = \text{Expected return of investment } i \text{ at time } t$$

As seen in the model, assets not affected by changes in the overall economy (i.e. with a Beta value of zero) will only return the risk free rate. However, assets that are affected by economic movements will “promise appropriately higher rates of return” (Sharpe, 1964).

2.2.2 Fama and French Three-factor Model (FF3)

The Fama and French Three-factor model introduced by Eugene F. Fama and Kenneth R. French (1993) expands on the Capital Asset Pricing Model by adding size risk and value risk factors to the existing market risk. This model also includes Jensen's Alpha which explains the abnormal return not explained by the different risk factors (Fama & French, 1993).

$$(R_{i,t} - R_{f,t}) = \alpha_{i,t} + \beta_1(R_{m,t} - R_{f,t}) + \beta_2 * SMB_t + \beta_3 * HML_t + \varepsilon_{i,t}$$

$R_{f,t}$ = Risk free rate of return at time t

$R_{m,t}$ = Market rate of return at time t

$R_{i,t}$ = Total return of investment i at time t

$(R_{i,t} - R_{f,t})$ = Excess return of investment i at time t

$(R_{m,t} - R_{f,t})$ = Risk premium of investment at time t

SMB_t = Size premium at time t (Small Minus Big)

(Historic excess return of small-cap companies over large-cap companies)

HML_t = Value premium at time t (High Minus Low)

(Historic excess return of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio))

β_1 = Beta of investment

β_2 = Beta of SMB

β_3 = Beta of HML

$\alpha_{i,t}$ = Jensen's Alpha, the abnormal excess return of investment i at time t

$\varepsilon_{i,t}$ = Error term of investment i at time t

2.2.3 Carhart Four-factor Model (C4)

The Carhart Four-factor Model is a factor addition to the Fama and French Three-factor Model proposed by Mark Carhart (1997). This model includes a momentum factor which is based on the assumption that assets that have performed well during the recent past, will continue to do so. Furthermore, the opposite applies for assets that have performed badly (Carhart, 1997).

$$(R_{i,t} - R_{f,t}) = \alpha_{i,t} + \beta_1(R_{m,t} - R_{f,t}) + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * MOM + \varepsilon_{i,t}$$

New additions

$MOM_t =$ Average returns of winning over losing companies at time t

$\beta_4 =$ Beta of MOM

2.2.4 Betting Against Beta (BAB)

Andrea Frazzini and Lasse Heje Pedersen (2014) presented the Betting Against Beta strategy, which consists of shorting stocks with a high Beta value and long stocks with a low Beta. In essence, the strategy itself is based on exploiting alleged inefficiencies in the Capital Asset Model in order to find market arbitrage. Predicting that high Beta assets are overpriced and low Beta assets are underpriced, which should in theory make the prices eventually align with each other and minimize risk exposure (Frazzini & Pedersen, 2014).

$$(R_{i,t} - R_{f,t}) = \alpha_{i,t} + \beta_1(R_{m,t} - R_{f,t}) + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * MOM + \beta_5 * BAB_t + \varepsilon_{i,t}$$

New additions

$BAB_t =$ Betting Against Beta factor

$\beta_5 =$ Beta of BAB

2.2.5 Fama and French Five-factor Model (FF5)

Fama and French continued to expand upon their previously well established Three-factor Model with the paper Fama and French (2014), where the newer Five-factor Model was presented. This model exposes the regression to both an investment and profitability factor in hopes of providing better description for the return (Fama & French, 2014).

$$(R_{i,t} - R_{f,t}) = \alpha_{i,t} + \beta_1(R_{m,t} - R_{f,t}) + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * RMW_t + \beta_5 * CMA_t + \varepsilon_{i,t}$$

New additions

$RMW_t =$ Profitability factor

(Historic excess return of most profitable companies over least profitable companies)

$CMA_t =$ Investment factor

(Historic excess return of conservatively investing companies over aggressively investing companies)

$\beta_4 =$ Beta of RMW

$\beta_5 =$ Beta of CMA

2.2.6 Sharpe Ratio

The Sharpe Ratio was developed and introduced by Sharpe (1994) and can help investors understand if a portfolio's excess returns are due to smart investment decisions or the result of portfolio-related risk (Sharpe, 1994; Fernando, 2021). As such, the following formula allows investors to calculate risk-adjusted return of a portfolio:

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

R_p = Return of portfolio

R_f = Risk free rate of return

σ_p = Standard deviation of portfolio

3. Analysis and Results

3.1 Regression Results

3.1.1 SINDEXT Returns

Table 4.1 presents the regression results of SINDEXT of the different regression models, for the whole sample time period, 1986-01-01 to 2021-01-01. The one-factor market Beta in the CAPM regression illustrates the defensiveness of the sin stock portfolio to market downturns, with a statistically significant Beta value of 0.80. Earlier studies on sin stock performance such as Hong & Kacperczyk (2009), Ozkan & Xiong (2009) and Salaber (2009) found similar results on initial regressions. When introduced to additional input variables from the FF3, C4 and FF5 models, adjusted R-squared continuously increased from 0.638 in CAPM and eventually capped out at 0.677 in the seventh and last regression. This in turn would suggest that the variance in sin stock excess returns are further explained by the inclusion of these added variables. Additionally, the market Beta gains a total increase of 0.05 units when additional variables are employed. However, the Beta value remains less than 1; suggesting that SINDEXT is indeed less volatile than the market and thus to a certain extent also recession resistant. In all seven regressions, Beta remained highly significant even when exposed to size, value, momentum, investment, profitability and betting against beta factors. These results seem consistent with those in existing literature and would confirm the recession resistant nature of sin stocks.

Interestingly enough, only exposure to the Fama and French value factor carries significance while the size factor fails to gain any significance throughout all regressions. Neither does the momentum factor show any significance in explaining the variance of SINDEXT excess returns. However, the more recently established BAB factor is highly significant whenever included, which is consistent with the findings of Blitz and Fabozzi (2017). Furthermore, both profitability and investment factors turn out to be initially significant, with the profitability factor clearly being the strongest and the investment factor losing its significance to the introduction of the BAB factor. Accounting for sin stock returns for assumed risk, we find that SINDEXT has a Sharpe ratio of 0.19, as seen in Table 5.

With all this in mind, exposure to all variables in the seventh regression decreases the significance of Jensen's Alpha, but doesn't render it completely insignificant. Suggesting that SINDEXT produces abnormally large returns for its assumed risk, at about 0.28 percent monthly.

In other words, this would indicate that a part of the excess returns generated by our sin stocks portfolio isn't explained by the included regressionary variables.

Table 4.1
Monthly time-series regression estimates: 1986-01-01 to 2021-01-01, SINDEX

	CAPM	FF3	C4	C4 & BAB	FF5	FF5 & MOM	FF5, MOM & BAB
Alpha (monthly)	0.56%*** 4.05	0.55%*** 4.01	0.53%*** 3.82	0.34%** 2.49	0.39%*** 2.84	0.38%*** 2.79	0.28%** 2.03
Rm-Rf	0.80*** 27.16	0.81*** 27.46	0.82*** 26.78	0.82*** 27.23	0.86*** 27.91	0.86*** 27.45	0.85*** 26.91
SMB		-0.04 -0.96	-0.04 -0.94	-0.04 -0.84	0.06 1.15	0.06 1.14	0.03 0.69
HML		0.15*** 3.31	0.16*** 3.46	0.06 1.14	0.00 0.01	0.01 0.10	-0.03 -0.44
MOM			0.03 1.02	-0.03 -0.98		0.01 0.30	-0.04 -1.09
BAB				0.30*** 5.93			0.25*** 4.74
RMW					0.32*** 4.99	0.32*** 4.92	0.23*** 3.39
CMA					0.18* 1.95	0.17* 1.88	0.10 1.12
Adjusted R-squared	0.638	0.646	0.646	0.669	0.666	0.666	0.677

This table reports all of the monthly regression results for all of the seven regressions utilized in this study. The label above each result column denotes the capital asset pricing model as well as any additional input variable used.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

3.1.2 SRINDEX Returns

In table 4.2 the results for all regressions on SRINDEX excess returns are depicted, for the whole sample period. Much like our sin stock portfolio, SRINDEX exhibits a low yet highly significant one-factor market Beta value of 0.74. What makes this interesting is that these results not only illustrate the defensiveness of socially responsible investing, but also suggests that this investment strategy is more defensive to market changes than a sinful investment strategy. However, the margin of defensiveness decreases when exposed to additional variables, as Beta increases with 0.07 units and the t-stat caps out at 31.94. Yet, it never reaches higher values than 0.83, which is less than 1 and thus confirming that SRI stocks also to some extent are recession resistant. Furthermore, later regressions exhibit a notably larger adjusted R-squared than the initial one-factor adjusted R-squared, before eventually dropping off a bit in the seventh regression. This in turn would indicate that initially at least, the inclusion of additional variables further explained the variance of SRINDEX excess returns, but eventually reached a threshold where additional input variables didn't add value to the results.

In all regressions, exposure to the classic Fama and French size factor is significantly negative, while the value factor starts out statistically indistinguishable from zero and doesn't gain significance until the fifth regression, which in turn also turns out to be significantly negative. In the third regression, Carhart's momentum factor carries relatively high positive significance, but loses out when allowed to compete with the BAB factor and FF5 factors. Both of the FF5 factors, profitability and investment, turn out to be significantly positive while also offering significant explaining power to our regressions, as the adjusted R-squared takes a sharp increase in the fifth regression. In the seventh and final regression, when all factors are allowed to compete, all but the momentum and BAB factor turns out to be highly significant, which is notably different from the sin stock portfolio results.

Much like the sin stock portfolio, throughout the regression process the Alpha value gets reduced due to exposure to additional variables, but never reaches insignificance. Thus, these regressionary results suggest SRINDEX also produces approximately 0.49 percent abnormal or otherwise non defined (within these models) excess monthly returns monthly. Additionally, Table 5 reveals a Sharpe ratio of 0.25, indicating a higher rate of return for each unit of assumed risk compared to the sin stock portfolio.

Table 4.2

Monthly time-series regression estimates: 1986-01-01 to 2021-01-01, SRINDEX

	CAPM	FF3	C4	C4 & BAB	FF5	FF5 & MOM	FF5, MOM & BAB
Alpha (monthly)	0.73%*** 6.33	0.73%*** 6.61	0.69%*** 6.22	0.59%*** 5.11	0.56%*** 5.17	0.54%*** 4.99	0.49%*** 4.42
Rm-Rf	0.74*** 30.16	0.76*** 31.75	0.78*** 31.48	0.77*** 30.63	0.82*** 33.51	0.83*** 33.27	0.81*** 31.94
SMB		-0.22*** -5.76	-0.21*** -5.73	-0.21*** -5.53	-0.11*** -2.73	-0.11*** -2.77	-0.10*** -2.66
HML		0.00 0.09	0.03 0.70	-0.03 -0.75	-0.16*** -3.40	-0.14*** -2.79	-0.17*** -3.29
MOM			0.06** 2.44	0.02 0.65		0.04 1.55	0.01 0.42
BAB				0.15*** 3.56			0.08* 1.77
RMW					0.35*** 6.88	0.34*** 6.69	0.32*** 5.95
CMA					0.20*** 2.79	0.18** 2.53	0.19*** 2.60
Adjusted R-squared	0.684	0.706	0.710	0.708	0.738	0.739	0.732

This table reports all of the monthly regression results for all of the seven regressions utilized in this study. The label above each result column denotes the capital asset pricing model as well as any additional input variable used.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

3.1.3 SAINTDEX Returns

Depicted in Table 4.3 are the regression results of SAINTDEX during the entire sample period. The estimated one-factor Beta is highly significant at 0.92. Although this Beta is less than 1, the difference is almost negligible. As such, confirming that the saint portfolio is only marginally more defensive than the market. This could partly be attributed to the fact that the saint portfolio contains a majority of large-cap and well established stocks, thus performing much like a stock market index.

In the third regression, this defensiveness margin increases slightly. In the third regression, the Fama and French turns out to be highly negatively significant. However, the size factor fails to achieve significance, being almost indistinguishable from zero in two of its six regressions. The value factor remains significant when allowed to compete with the Carhart momentum factor, further decreasing the market Beta value. However, when allowed to compete with the BAB factor in the fifth regression, momentum's significance falls off. Furthermore, the Fama and French profitability factor also fails to achieve significance throughout all regressions, while the investment factor starts out and remains significant in explaining the variance in excess returns. In the seventh and last regression, where all variables are allowed to compete, only four out of six coefficients are estimated to be significant. The adjusted R-squared has reached its highest value, suggesting that this combination of variables offers the most value in explaining the variance in saint stock excess returns. Yet, Jensen's Alpha has nothing but increased when exposed to additional variables. Additionally, what makes this interesting is the fact that the Alpha value is notably larger than both SINDEXT and SRINDEXT portfolios, suggesting that the SAINTDEX offers the best possible base excess returns out of the three alternatives. This despite the fact that the saint portfolio is estimated to be almost as volatile as the market. However, Table 5 suggests that when adjusting returns for assumed risk, the saint portfolio falls into second place behind SRINDEXT, with a Sharpe ratio of 0.23, just 0.02 short from SRINDEXT's Sharpe ratio of 0.25.

Table 4.3

Monthly time-series regression estimates: 1986-01-01 to 2021-01-01, SAINTDEX

	CAPM	FF3	C4	C4 & BAB	FF5	FF5 & MOM	FF5, MOM & BAB
Alpha (monthly)	0.72%*** 6.16	0.74%*** 6.55	0.78%*** 6.9	0.99%*** 8.82	0.82%*** 7.17	0.84%*** 7.36	1.01%*** 9.08
Rm-Rf	0.92*** 36.69	0.91*** 37.24	0.90*** 35.53	0.90*** 36.8	0.88*** 33.98	0.87*** 33.13	0.88*** 34.53
SMB		0.00 -0.12	-0.01 -0.19	-0.02 -0.59	-0.02 -0.37	-0.01 -0.33	0.00 -0.09
HML		-0.22*** -5.7	-0.24*** -6.2	-0.14*** -3.52	-0.08 -1.58	-0.11** -2.11	-0.05 -0.86
MOM			-0.07*** -2.58	-0.01 -0.42		-0.05** -2.03	0.00 -0.01
BAB				-0.22*** -5.25			-0.22*** -5.15
RMW					-0.04 -0.67	-0.02 -0.45	0.05 0.9
CMA					-0.30*** -3.97	-0.28*** -3.64	-0.25*** -3.35
Adjusted R-squared	0.763	0.779	0.782	0.784	0.786	0.787	0.809

This table reports all of the monthly regression results for all of the seven regressions utilized in this study. The label above each result column denotes the capital asset pricing model as well as any additional input variable used.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

Table 5

Sharpe ratios: 1986-01-01 to 2021-01-01, by portfolio

Portfolio	Average monthly mean return (%)	Average monthly mean excess return (%)	Monthly standard deviation of return (%)	Sharpe ratio
SINDEX	1.15	0.89	4.69	0.19
SRINDEX	1.29	1.04	4.19	0.25
SAINTDEX	1.35	1.10	4.89	0.23
Alcohol	1.50	1.25	5.62	0.22
Tobacco	1.26	1.01	5.97	0.17
Gambling	1.99	1.73	9.65	0.18
Defence & weapons	1.18	0.93	5.98	0.16
Fossil fuels	0.91	0.66	5.22	0.13
Cannabis	7.31	7.06	40.98	0.17
Soft drinks	1.09	0.84	6.49	0.13
Agriculture	1.86	1.60	6.67	0.24
Recreational services	0.32	0.07	5.65	0.01
Industrial engineering	1.53	1.28	6.73	0.19
Renewable & alternative energy	2.86	2.60	14.59	0.18
Pharmaceuticals	1.18	0.92	4.28	0.22

This table reports Sharpe ratios and different performance measurements for all three constructed portfolios and individually for all sin- and SRI comparable industries.

SINDEX denotes excess returns of the constructed sin stock portfolio; SRINDEX denotes excess returns of the constructed SRI comparables portfolio; SAINTDEX denotes excess returns of the constructed most ethical portfolio

3.2 Crisis Analysis

This section is dedicated to the regression analysis of each respective portfolio during the selected market downturns. Interpreting and concluding the performance and defensiveness of each investment strategy within a three-year time period around each crisis. These results are reported in Tables 6.1-6.3 and in some helpful graphs that can be found under each respective crisis segment.

Table 6.1

Monthly time-series regression estimates for five market downturns, SINDEXT

	1986-1989	1989-1992	2000-2003	2007-2010	2018-2021
Alpha (monthly)	-0.71% -0.88	0.93%* 1.93	0.55% 1.03	0.76% 1.38	-0.28% -0.70
Rm-Rf	0.58*** 3.02	0.52*** 5.64	1.03*** 7.65	0.91*** 8.42	0.95*** 11.15
SMB	-0.15 -0.38	-0.12 -0.58	-0.06 -0.44	-0.29 -1.32	0.01 0.07
HML	-0.38 -0.63	-0.61 -1.57	0.07 0.34	-0.33 -1.47	-0.16 -0.97
MOM	0.43 1.48	-0.09 -0.53	-0.01 -0.14	-0.01 -0.14	-0.09 -0.60
BAB	0.61* 1.95	0.19 1.07	0.49*** 2.64	0.09 0.47	-0.09 -0.54
RMW	1.08 1.48	0.02 0.04	0.07 0.35	0.13 0.37	-0.24 -0.83
CMA	0.72*** 5.15	0.46 1.03	0.03 0.16	-0.57 -1.31	0.40 1.40
Adjusted R-squared	0.710	0.538	0.635	0.797	0.877

This table reports all monthly regression results for the five regression periods. Rm-Rf denotes the excess returns for MSCI World; factors SMB, HML, RMW and CMA denotes all four Fama and French input factors, taken from Ken French's website; MOM denotes the Carhart momentum factor; BAB denotes the betting against beta factor, taken from AQR's website.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

Table 6.2

Monthly time-series regression estimates for five market downturns, SRINDEX

	1986-1989	1989-1992	2000-2003	2007-2010	2018-2021
Alpha (monthly)	1.15%** 2.38	0.91%*** 2.60	0.01% 0.01	1.13%*** 3.23	0.33% 1.17
Rm-Rf	0.66*** 5.74	0.82*** 12.26	0.54*** 3.13	0.85*** 12.43	0.81*** 13.34
SMB	-0.38* -1.67	0.20 1.28	-0.14 -0.78	-0.09 -0.64	-0.13 -0.99
HML	-0.78** -2.21	-0.27 -0.96	-0.12 -0.46	-0.03 -0.24	-0.21* -1.83
MOM	-0.12 -0.72	0.24* 1.89	0.01 0.10	0.08 1.55	-0.03 -0.30
BAB	0.40** 2.12	-0.054 -0.43	0.052 0.22	-0.04 -0.32	-0.04 -0.32
RMW	0.06 0.13	-0.04 -0.12	0.21 0.80	-0.16 -0.74	-0.28 -1.36
CMA	-0.31 -0.83	-0.20 -0.60	0.37 1.49	0.27 0.98	0.48** 2.40
Adjusted R-squared	0.851	0.872	0.212	0.902	0.893

This table reports all monthly regression results for the five regression periods. Rm-Rf denotes the excess returns for MSCI World; factors SMB, HML, RMW and CMA denotes all four Fama and French input factors, taken from Ken French's website; MOM denotes the Carhart momentum factor; BAB denotes the betting against beta factor, taken from AQR's website.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

	1986-1989	1989-1992	2000-2003	2007-2010	2018-2021
Alpha (monthly)	0.40% 0.61	0.30% 0.60	2.47%*** 6.84	1.09%*** 4.40	0.69%*** 3.17
Rm-Rf	0.63*** 3.93	0.45*** 4.76	0.95*** 10.53	1.01*** 20.87	0.97*** 20.96
SMB	-0.06 -0.20	-0.12 -0.57	0.08 0.87	0.02 0.16	-0.14 -1.34
HML	-0.20 -0.40	-0.99** -2.46	-0.11 -0.80	-0.19* -1.91	-0.01 -0.17
MOM	0.38 1.59	-0.23 -1.29	0.04 0.76	0.06 1.48	0.03 0.36
BAB	0.44* 1.68	0.11 0.63	-0.67*** -5.35	-0.32*** -3.90	0.03 0.28
RMW	0.88 1.46	0.06 0.14	0.41*** 3.03	-0.24 -1.55	-0.06 -0.38
CMA	-0.96* -1.83	-0.29 -0.62	-0.14 -1.10	0.23 1.20	-0.20 -1.32
Adjusted R-squared	0.805	0.653	0.932	0.965	0.961

This table reports all monthly regression results for the five regression periods. Rm-Rf denotes the excess returns for MSCI World; factors SMB, HML, RMW and CMA denotes all four Fama and French input factors, taken from Ken French's website; MOM denotes the Carhart momentum factor; BAB denotes the betting against beta factor, taken from AQR's website.

*t-statistics are represented in bold and italic format. * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.*

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

3.2.1 First Crisis Period (1986-1989)

In Table 6.1, we see that our sin stock portfolio has a highly significant estimated market Beta of 0.58, indicating that sin stocks are recession resistant during this time period. Note that Table 6.2 and 6.3 estimated significant market Betas for both SRINDEX and SAINTDEX during the same

time period. However, these are larger than the one estimated for SINDEX, seemingly confirming sin stocks superior defensiveness, during this restricted period. Furthermore, it should be noted that SRINDEX exhibits a significant positive Jensen's Alpha, which none of the other portfolios do. This in turn means that our SRI comparables portfolio realized more abnormal excess returns than expected. These findings are further supported by the fact that SRINDEX earned an average monthly return of 2.12 percent, compared to our sin stock portfolio which only earned about 1.16 percent in average monthly returns. As such, while our sin stocks portfolio would suggest that sin stocks are more recession resistant, SRINDEX performed better when viewing these assets as raw investment prospects. Seen in Table 7, adjusting these returns for risk reveals a notably higher Sharpe ratio for SRINDEX at about 0.4 compared to SINDEX's Sharpe ratio of 0.2 and SAINTDEX's Sharpe ratio of 0.1, further confirming SRINDEX's superior performance per each unit of assumed risk, during this time period. Compounded returns and monthly return fluctuations for all three portfolios are illustrated in Figure 1 and 2.

Figure 1

Compounded returns for SINDEX, SRINDEX and SAINTDEX, between 1986-01-01 and 1989-01-01

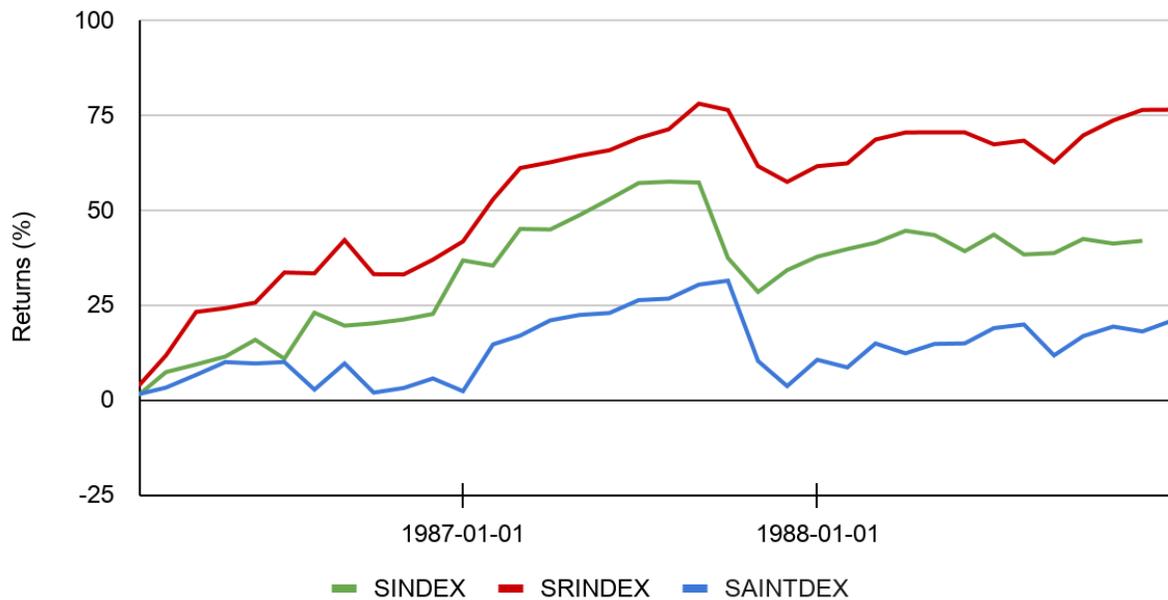
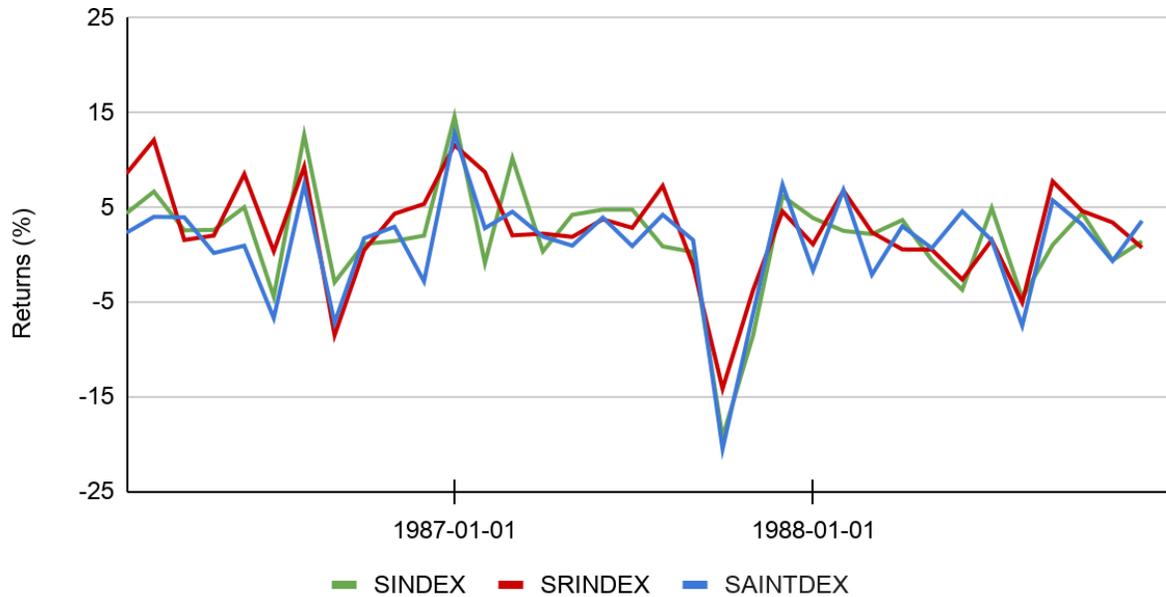


Figure 2

Returns for SINDEX, SRINDEX and SAINTDEX, between 1986-01-01 and 1989-01-01



3.2.2 Second Crisis Period (1989-1992)

The results seen in Table 6.1 estimates a highly significant low market Beta for SINDEX. Notably lower than our SRI comparables portfolio in Table 6.2, but 0.7 units higher than the saint stock portfolio in Table 6.3. Suggesting that sin stocks during this time period are less volatile than the market and SRINDEX, however still estimated to be more volatile than SAINTDEX. Furthermore, both our sin stock and SRI stocks portfolio reposted statistically significant Alphas. But only SRINDEX managed to cross the 10 percent threshold at about 0.93 percent higher monthly excess returns than expected. Since SINDEX exhibits lower yet still significant Alpha, we can not conclude that this is due to the Alpha being explained by the regression variables included. Rather, we may only conclude that it may be the cause for the lower significance, but the model still fails to achieve full explaining power over sin stocks' abnormal returns.

Focusing on the return statistics, we observe that our SRI stock portfolio yielded an average monthly return of about 1.21 percent, surpassing our sin stock portfolio at an average monthly return of about 1.13 percent and the saint portfolio at a mere average monthly return of

0.74 percent. Additionally, Table 7 reveals that SAINTDEX had the worst Sharpe ratio out of them all at 0.19, while SININDEX had the highest at 0.34. Showcasing that despite its higher average monthly return, SRINDEX featured larger price fluctuations and higher standard deviation during this time period, seen in Figure 3 and 4. As such, the amount of return per unit of assumed risk for SRINDEX is lower than the SININDEX'. Seemingly confirming that sin stocks were less volatile (more recession resistant) during this time period.

Figure 3

Compounded returns for SININDEX, SRINDEX and SAINTDEX, between 1989-01-01 and 1992-01-01

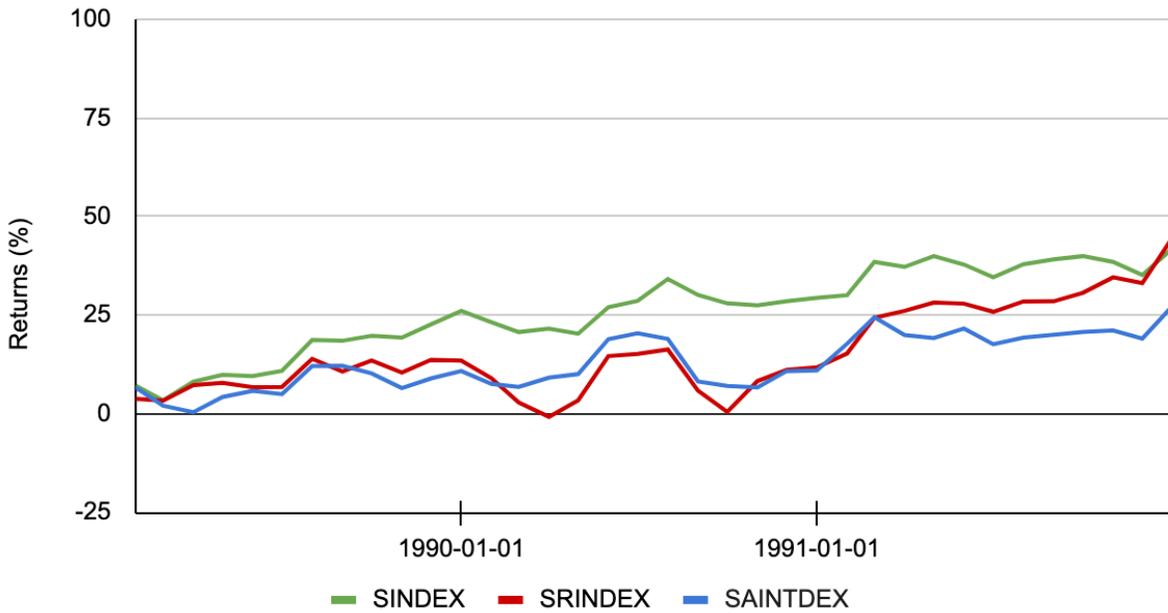
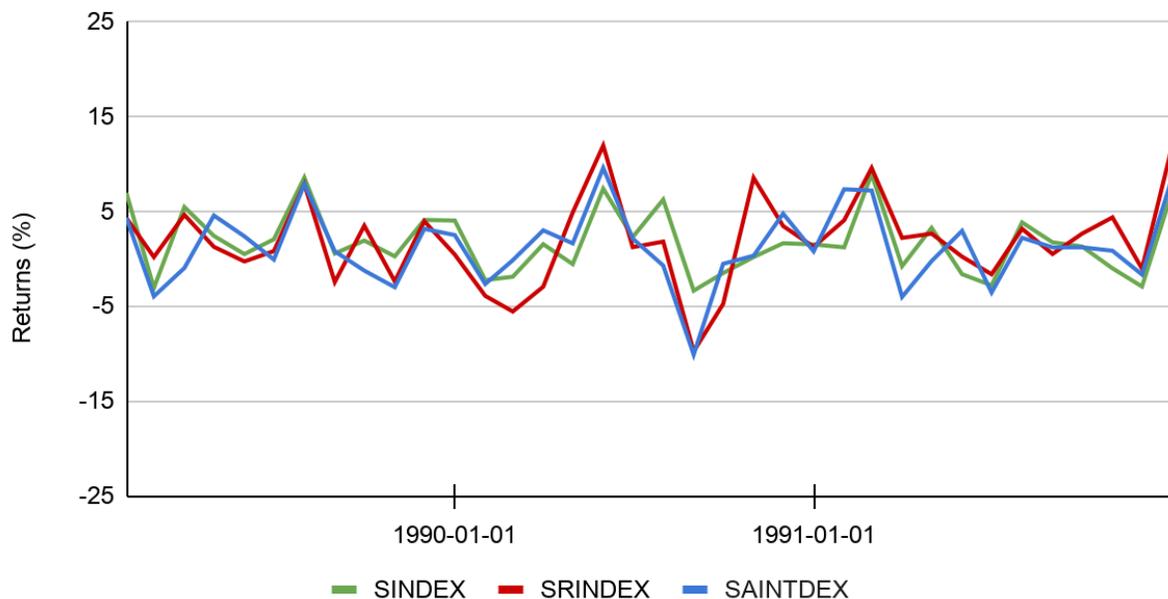


Figure 4

Returns for SININDEX, SRINDEX and SAINTDEX, between 1989-01-01 and 2001-01-01



3.2.3 Third Crisis Period (2000-2003)

In Table 6.1, we see that this is the only period in which our sin stock portfolio reports a highly significant market Beta larger than 1. Which would indicate that sin stocks during this time were more volatile than the market; recession sensitive. Additionally, SININDEX is estimated to have a significant dependency on the BAB factor, which generally seems to favor low-Beta equities, even though the sin stock portfolio exhibits a relatively large Beta value. Seen in Table 6.2 and 6.3, SRINDEX features a distinctively lower yet still statistically significant market Beta of only 0.54, while SAINTDEX came in at 0.95, not really significantly different from the market. Due to our saint portfolio containing many large and well-established companies, this is not too surprising, as market indexes usually utilized these companies as a reflection of the market's movements.

It should be noted that SAINTDEX had two significant dependencies, positively on the Fama and French profitability factor and negatively on the BAB factor. Furthermore, SAINTDEX was the only portfolio out of the three during this time period, with a statistically significant Jensen's Alpha of 2.47 percent. Yet, it did not yield the highest average monthly return, with a mere 0.03 percent. The other two portfolios also proved to perform relatively poorly during this time, but succeeded to outperform SAINTDEX. The average monthly return of our sin stock portfolio was 0.05 percent, reigning supreme. While SRINDEX actually had a negative average monthly return of -0.2 percent. Adjusted for assumed risk, SRINDEX also proved to have the lowest Sharpe ratio of -0.05, seen in Table 7. With SININDEX remaining supreme with a Sharpe ratio of 0.01 and SAINTDEX taking the second place with a Sharpe ratio statistically indistinguishable from 0. As such, sin stocks further provide evidence to be the more recession resistant and less volatile investment strategy. This can also be seen in Figure 5 and 6, illustrating the compounded and monthly returns of all three portfolios during.

Figure 5

Compounded returns for SINDEX, SRINDEX and SAINTDEX, between 2000-01-01 and 2003-01-01

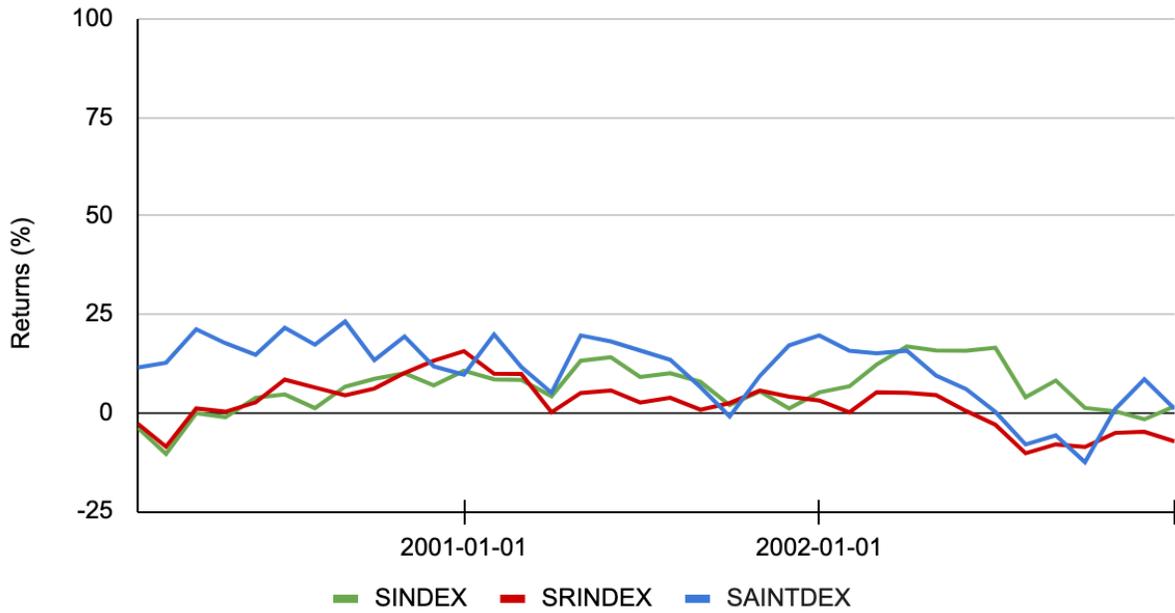
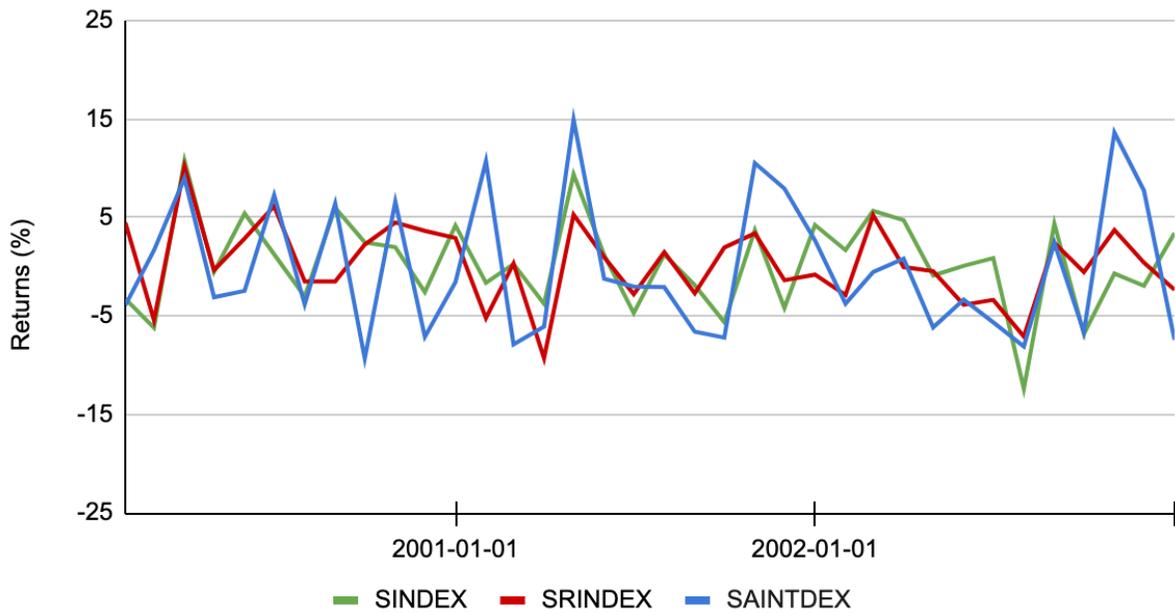


Figure 6

Returns for SINDEX, SRINDEX and SAINTDEX, between 2000-01-01 and 2003-01-01



3.2.4 Fourth Crisis Period (2007-2010)

In Table 6.1-6.3 we find that both SINDEX and SRINDEX exhibit highly statistically significant market Betas of 0.91 and 0.85 respectively, indicating a small yet notable recession resistance for both portfolios. However, our saint portfolio was estimated to have a market Beta larger than 1, thus being deemed more volatile than the market and recession sensitive. Furthermore, both SRINDEX and SAINTDEX were estimated to have highly significant positive Jensen Alphas at 1.13 percent and 1.09 percent respectively, while SINDEX showed an insignificant Alpha of 0.47 percent. Which may be due to the explanatory power of the models included variables and would be consistent with previous literature like Blitz and Fabozzi (2017). Figure 7 and 8 reveals a pretty even spread of compound and monthly returns. SRINDEX taking the lead with an average monthly return of 0.52 percent, followed by SINDEX' 0.51 percent and SAINTDEX underperforming both at 0.47 percent. These results can also be seen reflected in the risk-adjusted returns of Table 7. SRINDEX achieved a Sharpe ratio of 0.09, compared to the other two's Sharpe ratios of 0.07. Meaning that the SRI stock portfolio outperformed both the sin stock portfolio and the saint stock portfolio per unit of assumed risk, during this time period.

Figure 7

Compounded returns for SINDEX, SRINDEX and SAINTDEX, between 2007-01-01 and 2010-01-01

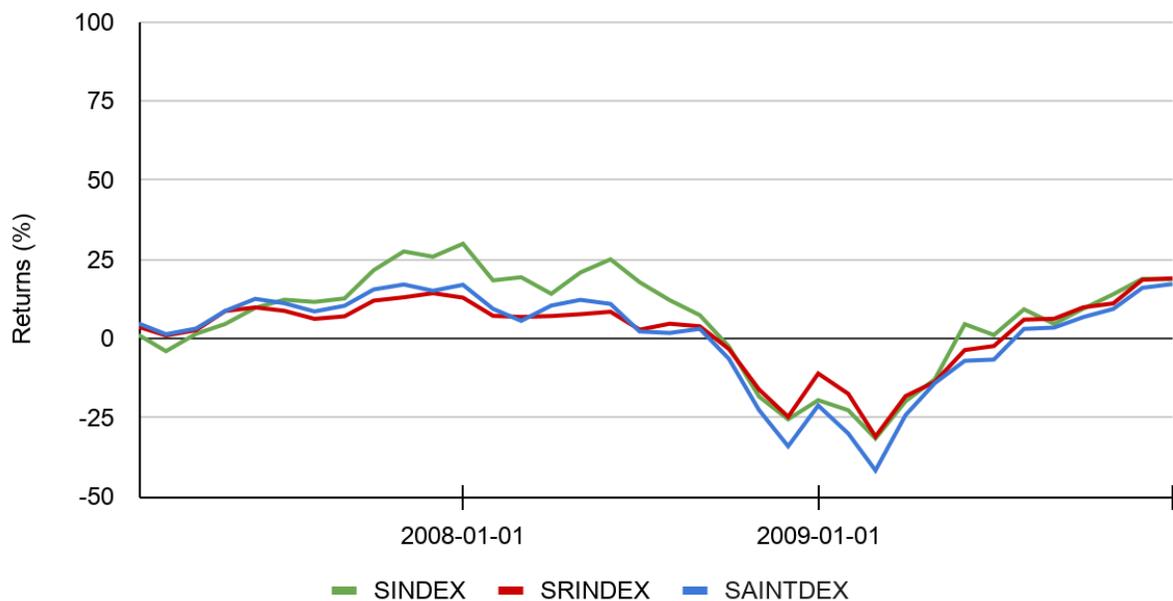
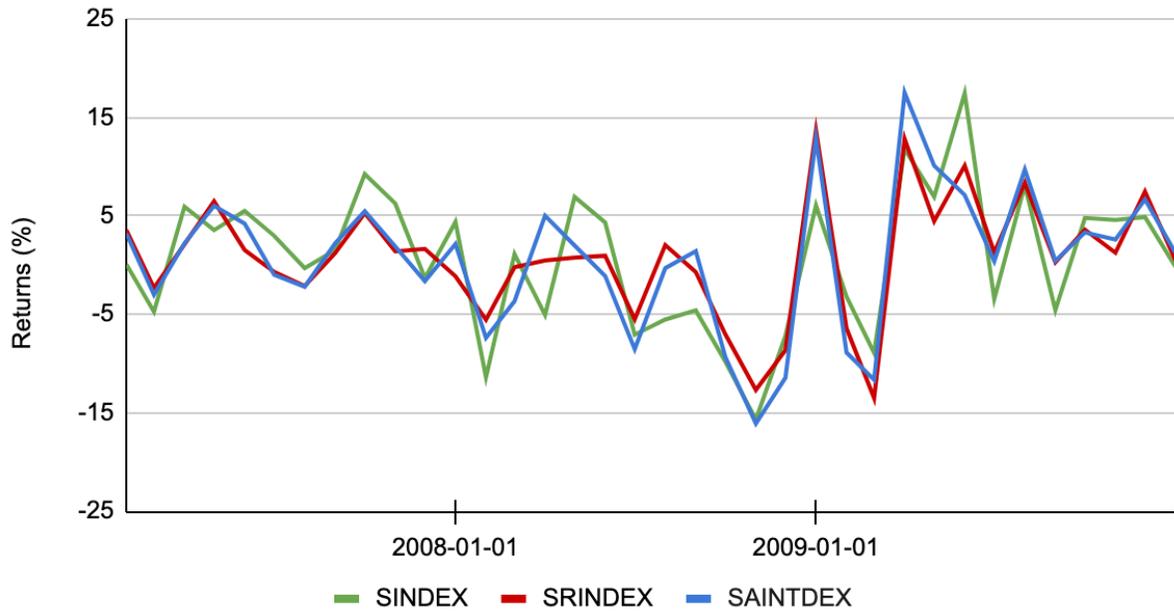


Figure 8

Returns for SINDEX, SRINDEX and SAINTDEX, between 2007-01-01 and 2010-01-01



3.2.5 Fifth Crisis Period (2018-2021)

According to our regression results in Table 6.1-6.3, all market Betas were highly significant and lower than 1. The SRI stock portfolio was estimated to have a Beta value of 0.81, followed by the sin stock portfolio with 0.95 and the saint portfolio with 0.97. Indicating the defensiveness of socially responsible investing in recent years. Out of all three portfolios, SAINTDEX was the only one with an estimated significant Alpha value of 0.69 percent, while SINDEX displayed an insignificant and negative Alpha.

Looking at the data in Figure 9 and 10, we see that the saint portfolio performed its best during this crisis period, compared to the other periods. Additionally, SAINTDEX had an average monthly return of 1.54 percent, outperforming SINDEX' 0.53 percent and SRINDEX' 1.13 percent. The sin stock portfolio performed notably badly during the start of the COVID-19 pandemic, with a large dip into the negatives, seen in Figure 9. Adjusting for assumed risk, we find that even though the difference in returns now is smaller, the saint portfolio still reigns supreme. Reporting a Sharpe ratio of 0.28, just 0.02 more than SRINDEX' Sharpe ratio of 0.26 and far superior compared to SINDEX' Sharpe ratio of 0.09. This could be interpreted as

evidence for shifting investor interests and a growing awareness of investment ethics. As such, the saint portfolio presents itself as the clearly more safe and profitable investment out of the three during this time period, whereas the sin stock portfolio underperformed with the lowest average monthly return and significantly lower Sharpe ratio.

Figure 9

Compounded returns for SINDEX, SRINDEX and SAINTDEX, between 2018-01-01 and 2021-01-01

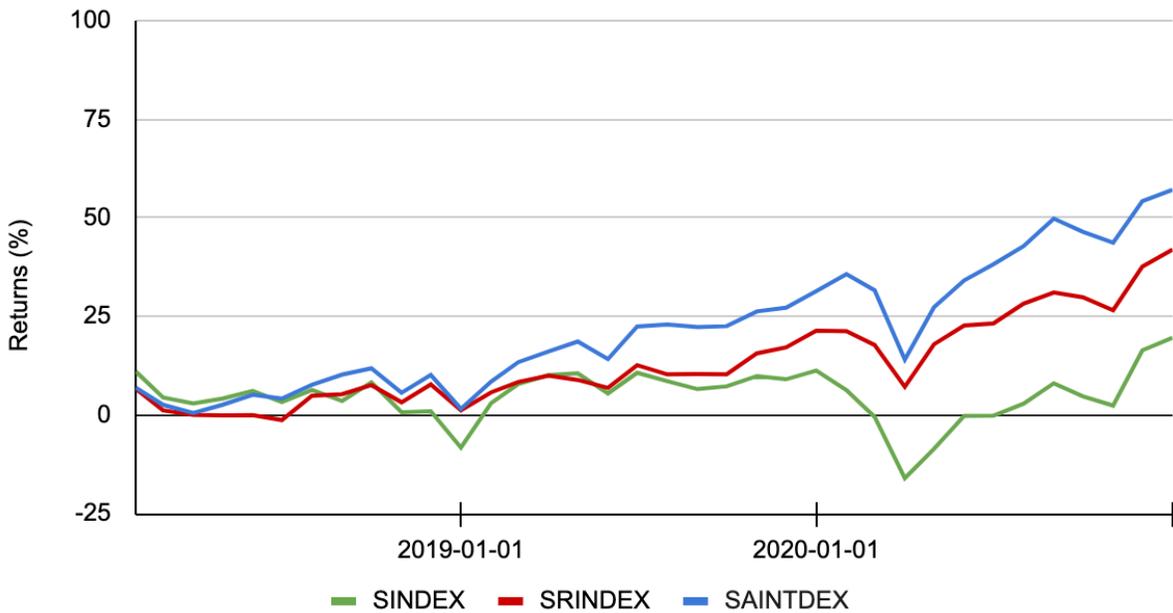


Figure 10

Returns for SINDEX, SRINDEX and SAINTDEX, between 2018-01-01 and 2021-01-01

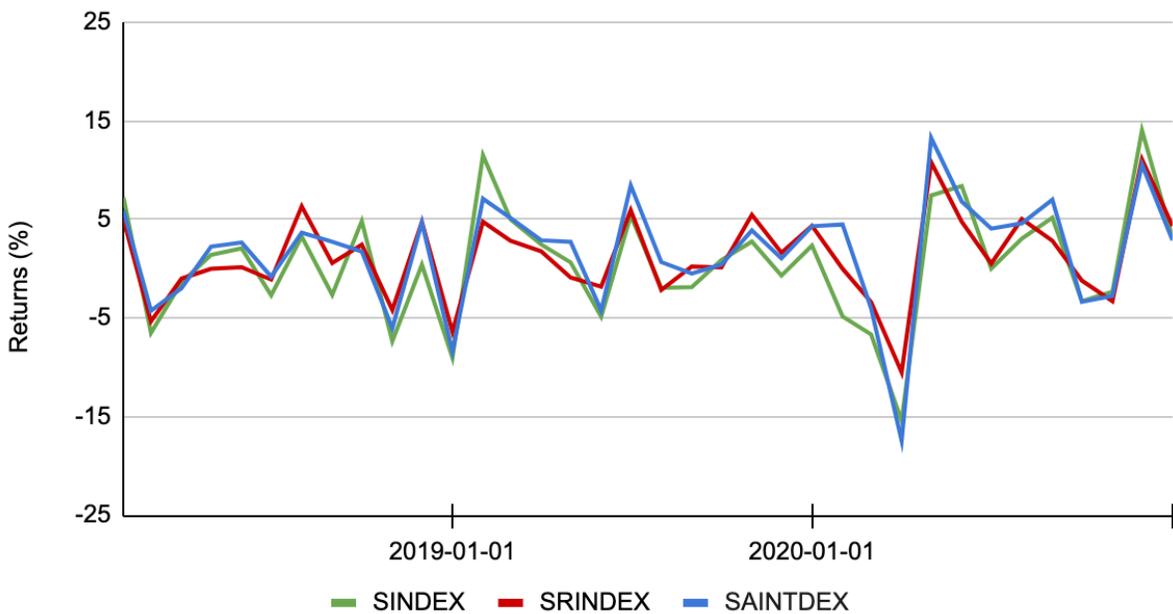


Table 7
Sharpe ratios during market downturns, by portfolio

Portfolio		SINDEX	SRINDEX	SAINTDEX
1986-1989	Average monthly mean return (%)	1.65	2.61	1.07
	Average monthly mean excess return (%)	1.16	2.12	0.58
	Monthly standard deviation of return (%)	5.80	5.30	5.64
	Sharpe ratio	0.20	0.40	0.10
1989-1992	Average monthly mean return (%)	1.72	1.80	1.33
	Average monthly mean excess return (%)	1.13	1.21	0.74
	Monthly standard deviation of return (%)	3.37	4.58	3.96
	Sharpe ratio	0.34	0.26	0.19
2000-2003	Average monthly mean return (%)	0.36	0.12	0.34
	Average monthly mean excess return (%)	0.05	-0.20	0.03
	Monthly standard deviation of return (%)	4.65	4.10	7.27
	Sharpe ratio	0.01	-0.05	0.00
2007-2010	Average monthly mean return (%)	0.69	0.69	0.65
	Average monthly mean excess return (%)	0.51	0.52	0.47
	Monthly standard deviation of return (%)	6.96	5.97	7.01
	Sharpe ratio	0.07	0.09	0.07
2018-2021	Average monthly mean return (%)	0.65	1.25	1.66
	Average monthly mean excess return (%)	0.53	1.13	1.54
	Monthly standard deviation of return (%)	5.81	4.43	5.59
	Sharpe ratio	0.09	0.26	0.28

This table reports Sharpe ratios and different performance measurements for all three constructed portfolios, during all five different recession periods.

SINDEX denotes excess returns of the constructed sin stock portfolio; SRINDEX denotes excess returns of the constructed SRI comparables portfolio; SAINTDEX denotes excess returns of the constructed most ethical portfolio

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

3.3 Industry Analysis

This section is dedicated to the examination of each respective sin industry in greater detail. Presenting figures for compounded returns, comparing each respective sin industry against the constructed sin stock portfolio and the market. Additionally, individual regressionary results during each of the selected market downturns are presented in Table 8, while return-related metrics together with Sharpe ratios are illustrated in Table 9.

Before proceeding, it is worth noting that during the second and third crisis periods in Table 8, adjusted R-squared are quite low across the board, suggesting that the variables included in our model offer very little value in explaining excess returns during these restricted time periods. As such, this will be kept in mind when attempting to draw any sort of conclusion based on these results.

Table 8
Monthly time-series regression estimates for five market downturns, sin sub-portfolios

Time period	Industry	Alpha (monthly)	Rm-Rf	SMB	HML	MOM	BAB	RMW	CMA	Adjusted R-squared
1986-1989	ALCO	1.79%**	0.76***	0.03	-0.37	0.94***	-0.10	-0.20	-0.70	0.797
	TOBAC	0.79%	0.65**	-0.40	-0.28	0.55	0.68	0.22	-0.94	0.485
	GAMB	-4.42%	0.15	-0.57	-4.30	-1.68	2.04	5.33	7.14**	0.086
	WEAP	0.83%	0.77*	-0.363	0.36	0.13	1.04	-0.09	-2.36*	0.406
	FOSSIL	-1.55%*	0.54**	-0.05	-0.45	0.44	0.57*	1.55*	1.65**	0.678
	CANN	-1.70%	-1.16	1.84	-1.41	-0.21	0.29	2.10	0.78	-0.194
1989-1992	ALCO	1.75%***	0.79***	-0.52**	-0.30	0.22	0.29	-0.64	-0.71	0.773
	TOBAC	1.49%	0.60***	0.301	-1.28	-0.13	-0.10	1.19	1.14	0.257
	GAMB	2.89%**	-0.55**	0.58	0.85	-0.04	1.37***	-0.73	-2.44**	0.332
	WEAP	0.14%	0.35**	0.27	-0.26	0.25	0.20	-0.20	-1.58**	0.421
	FOSSIL	0.76%	0.49***	-0.29	-0.42	-0.17	0.26	-0.36	0.69	0.422
	CANN	11.00%	1.19	3.10	-0.51	-1.51	-0.73	-1.29	3.23	-0.133
2000-2003	ALCO	-0.29%	0.64***	0.35**	0.55**	0.12	0.28	0.22	-0.37	0.476
	TOBAC	1.34%	0.90***	-0.22	-0.01	0.11	0.17	0.34	0.30	0.147
	GAMB	1.18%	0.55*	-0.43	0.26	0.32*	0.47	-0.20	-0.08	0.128
	WEAP	0.55%	0.97***	0.11	0.39	0.05	-0.09	0.51	0.18	0.367
	FOSSIL	0.38%	1.10***	-0.08	-0.005	-0.05	0.65***	-0.05	-0.008	0.555
	CANN	3.81%	0.86	0.07	0.75	0.11	0.65	-1.26	-0.70	0.079
2007-2010	ALCO	2.57%***	0.84***	0.234	-0.33	-0.01	0.30	-0.74	-0.27	0.696
	TOBAC	1.06%*	0.63***	0.06	0.07	0.07	0.278	-0.39	0.01	0.732
	GAMB	1.71%	-0.41	-0.10	0.90	-1.14***	3.72***	-0.72	-2.13	0.541
	WEAP	0.36%	0.77***	0.02	0.03	-0.23**	-0.07	-0.26	-0.40	0.771
	FOSSIL	0.53%	0.96***	-0.44	-0.40	0.02	0.06	0.35	-0.74	0.717
	CANN	5.47%**	1.20**	1.45	-0.89	-0.62	2.84***	-0.15	-2.57	0.557
2018-2021	ALCO	0.74%	0.85***	0.42	-0.49	-0.21	0.33	0.39	0.42	0.567
	TOBAC	-1.43%**	0.53***	-0.12	-0.34	-0.59**	0.28	0.08	0.43	0.535
	GAMB	0.42%	-0.53	0.68	-0.22	-0.16	2.17***	-1.16	-2.00	0.271
	WEAP	0.07%	1.36***	-0.30	0.35	0.08	-0.28	-0.94	-0.45	0.751
	FOSSIL	-0.62%	0.94***	0.01	-0.16	0.02	-0.24	-0.40	0.76**	0.762
	CANN	1.48%	2.20**	0.68	-1.16	-0.24	-1.53	-1.13	0.84	0.067

This table reports all of the regression results for all sin sub-portfolios during all five recession periods. Rm-Rf denotes the excess returns for MSCI World; factors SMB, HML, RMW and CMA denotes all four Fama and French input factors, taken from Ken French's website; MOM denotes the Carhart momentum factor; BAB denotes the betting against beta factor, taken from AQR's website.

Statistically significant coefficients are in bold format: * statistically significant at the 0.1 level; ** statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

Rm-Rf denotes excess returns of MSCI World over the risk free rate of return.

Table 9
Sharpe ratios during market downturns, by sin sub-portfolio

Portfolio		ALC	TOBAC	GAMB	WEAP	FOSSIL	CANN
1986-1989	Average monthly mean return (%)	7.06	7.48	15.11	7.76	6.15	11.62
	Average monthly mean excess return (%)	1.46	1.98	-0.20	0.09	1.11	-1.33
	Monthly standard deviation of return (%)	1.94	2.47	0.29	0.57	1.59	-0.85
	Sharpe ratio	0.21	0.26	-0.01	0.01	0.18	-0.11
1989-1992	Average monthly mean return (%)	5.02	5.68	7.48	5.11	3.52	34.4
	Average monthly mean excess return (%)	1.93	2.17	2.43	0.47	0.46	6.99
	Monthly standard deviation of return (%)	2.52	2.76	3.02	1.06	1.05	7.59
	Sharpe ratio	0.38	0.38	0.32	0.09	0.13	0.20
2000-2003	Average monthly mean return (%)	4.7	7.25	7.38	6.59	5.31	13.88
	Average monthly mean excess return (%)	0.28	0.89	1.08	0.75	-0.46	2.44
	Monthly standard deviation of return (%)	0.60	1.21	1.40	1.07	-0.14	2.75
	Sharpe ratio	0.06	0.12	0.15	0.11	-0.09	0.18
2007-2010	Average monthly mean return (%)	8.08	5.67	16.91	8.07	7.66	21.47
	Average monthly mean excess return (%)	1.74	0.28	1.13	-0.13	0.45	5.48
	Monthly standard deviation of return (%)	1.92	0.46	1.31	0.05	0.64	5.66
	Sharpe ratio	0.21	0.05	0.07	-0.02	0.06	0.26
2018-2021	Average monthly mean return (%)	7.05	5.32	10.19	8.72	5.74	27.88
	Average monthly mean excess return (%)	1.68	-0.86	0.89	0.73	0.09	4.45
	Monthly standard deviation of return (%)	1.80	-0.74	1.02	0.85	0.21	4.57
	Sharpe ratio	0.24	-0.16	0.09	0.08	0.02	0.16

This table reports Sharpe ratios and different performance measurements for all sin sub-portfolios, during all five different recession periods.

Data used for each period: 1986-1989 is from 1986-01-01 to 1989-01-01; 1989-1992 is from 1989-01-01 to 1992-01-01; 2000-2003 is from 2000-01-01 to 2003-01-01; 2007-2010 is from 2007-01-01 to 2010-01-01; 2018-2021 is from 2018-01-01 to 2021-01-01.

3.3.1 Alcohol Industry

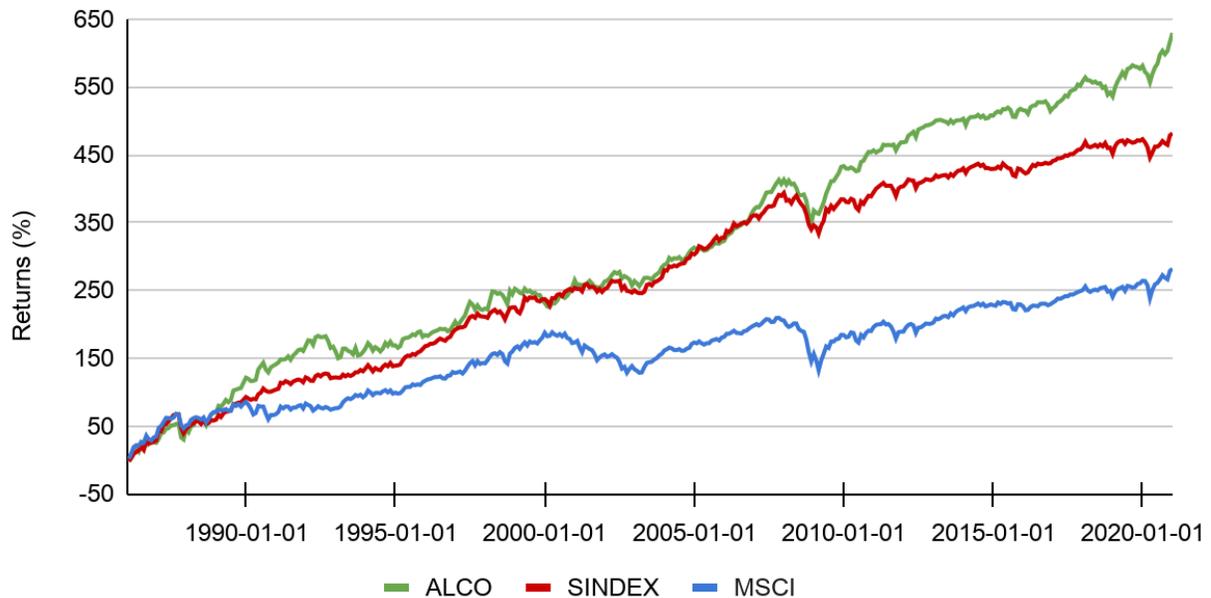
Figure 11 depicts the compounded returns of the entire sin stock portfolio (SINDEX), the market portfolio (MSCI) and the alcohol industry sub-portfolio (ALCO), over the entire sample period. Note that the alcohol portfolio generally outperforms both of the comparison portfolios with the occasional significant jump in returns, furthering its relative outperformance. Adjusting these

returns for assumed risk reveals a consistently larger Sharpe ratio than that of the sin stock portfolio, seen in Table 9 and 7 respectively.

Furthermore, Table 8 reveals that ALCO has statistically significant Alpha values in crisis period one, two and four, at around 2 percent per month over the market, suggesting that there might be some industry-specific abnormal returns associated with the alcohol industry during market downturns. The market Beta value is also consistently significant and positive, but less than 1, suggesting that the alcohol industry remains defensive and thus also recession resistant, even during downturn periods. Interestingly, the alcohol industry is the only sin industry showing significant dependency on the Fama and French size and value factors, which occurred during the second and third crisis period.

Figure 11

Compounded returns for SINDEX, MSCI and ALCO



3.3.2 Tobacco Industry

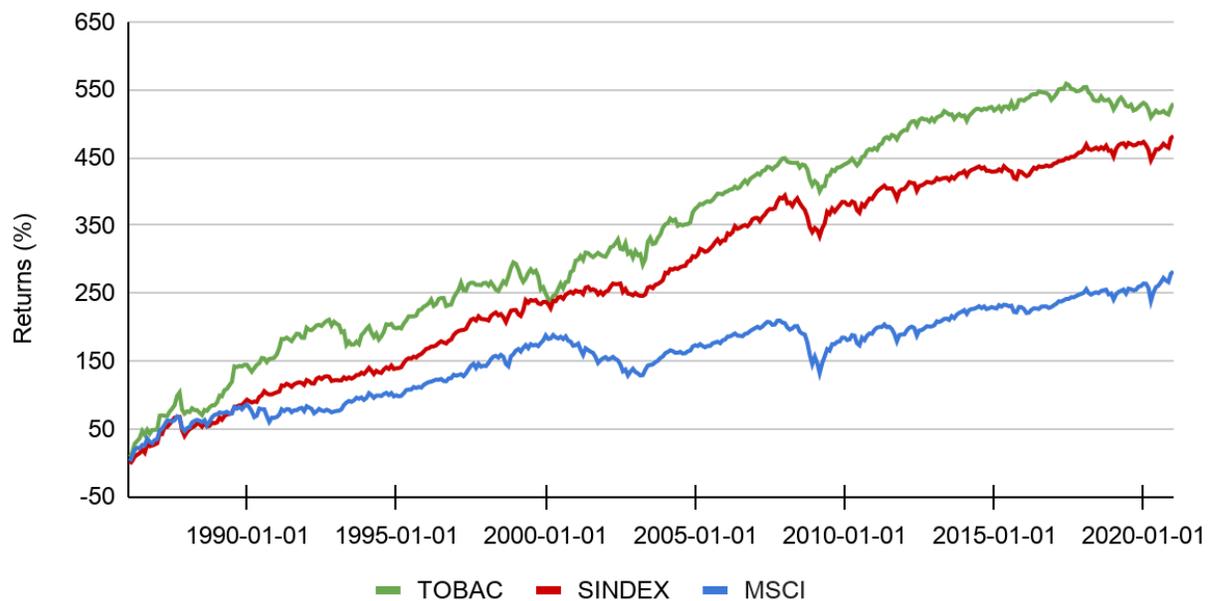
Figure 12 illustrates the compounded returns of our sin portfolio (SINDEX), the market portfolio (MSCI) and the tobacco industry sub-portfolio (TOBAC), during the entire sample time period. In this graph of compounded historical returns, we see that the tobacco portfolio almost consistently outperforms both the sin stock portfolio and the market portfolio. Yet when

adjusting for assumed risk, we see in Table 9 and 7 that the tobacco stock portfolio’s Sharpe ratio only exceeds the sin stock portfolio’s during the first three crisis periods.

Additionally, the regression results seen in Table 8 suggest that while the tobacco portfolio had significantly small market Beta values throughout all but the third crisis periods, only two out of the five exhibited significant Alphas. Amongst which, one was highly negative at a monthly rate of return at -1.43 percent under the market in the period between 2018 and 2021, suggesting a change and investment behaviour and attitude about tobacco investments amongst investors. Furthermore, all input variables were allowed to compete in all of the five conducted crisis regression, the tobacco portfolio only proved significantly dependent on the Carhart momentum factor in the fifth and last crisis period. This dependency was also estimated to be significantly negative.

Figure 12

Compounded returns for SINDEX, MSCI and TOBAC



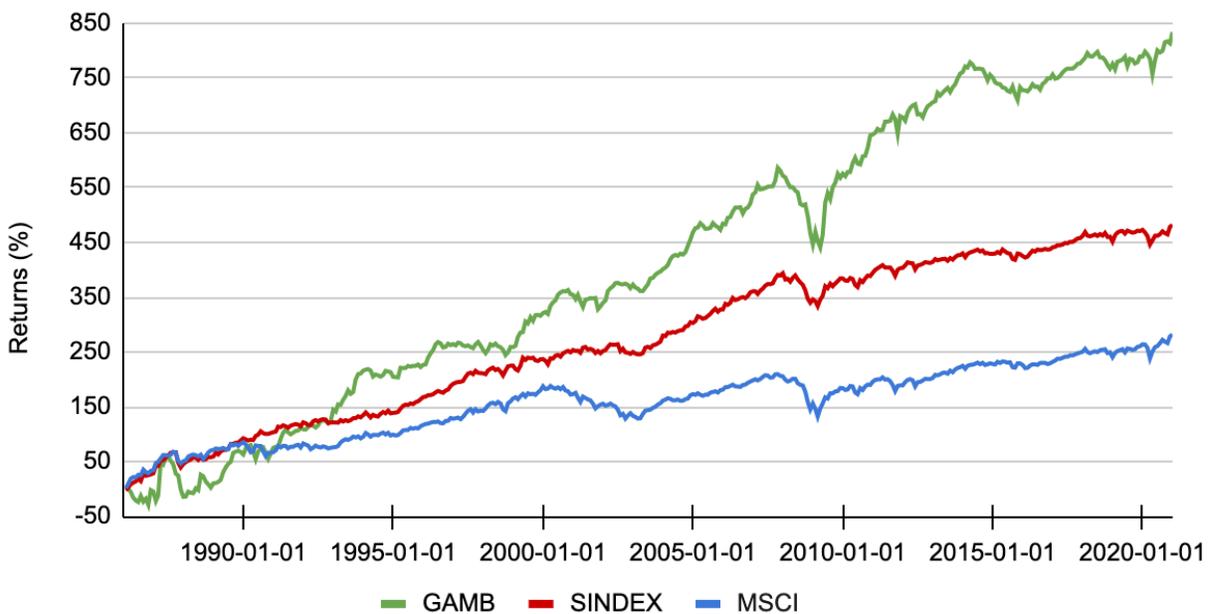
3.3.3 Gambling Industry

Figure 13 presents the compounded returns of the sin stock portfolio (SINDEX), the market portfolio (MSCI) and the gambling portfolio (GAMB), over the entire sample period. Observe that the gambling industry exhibited steady and continuous overperformance after about 1993

when compared the aforementioned portfolios. Some would argue that the gambling industry is one of the most recession resistant industries. According to the regression results shown in Table 8, this would appear to be true. The regression estimates show notably low yet highly significant Beta values in a majority of the crisis periods, even suggesting being recession proof between 1989 to 1992 with a Beta value of -0.55. However, despite these Beta values seemingly confirming the gambling industry’s defensiveness during market downturns, note that the gambling portfolio experienced a significantly higher loss during 2008, with an accumulated loss exceeding 100 percent. This volatility seems to remain during the fifth and latest crisis period, dropping more than both the sin stock portfolio and the market portfolio. Furthermore, the gambling portfolio was only estimated to have a significant Alpha value during the second crisis period. But when keeping in mind that said regression adjusted R-squared is very low, we may assume that these abnormal returns may only be the result of lacking exposure to unknown input variables. Additionally, estimates only found significant dependencies on the BAB factor, Fama and French investment factor and Carhart momentum factor. Amongst which the dependency on the investment factor was consistently significantly negative.

Looking at the results in Table 7 and 9, we find that the gambling portfolio only exhibits a larger Sharpe ratio compared to SINDEX in the third crisis periods and performing on par with SINDEX in the fourth and fifth.

Figure 13
Compounded returns for SINDEX, MSCI and GAMB

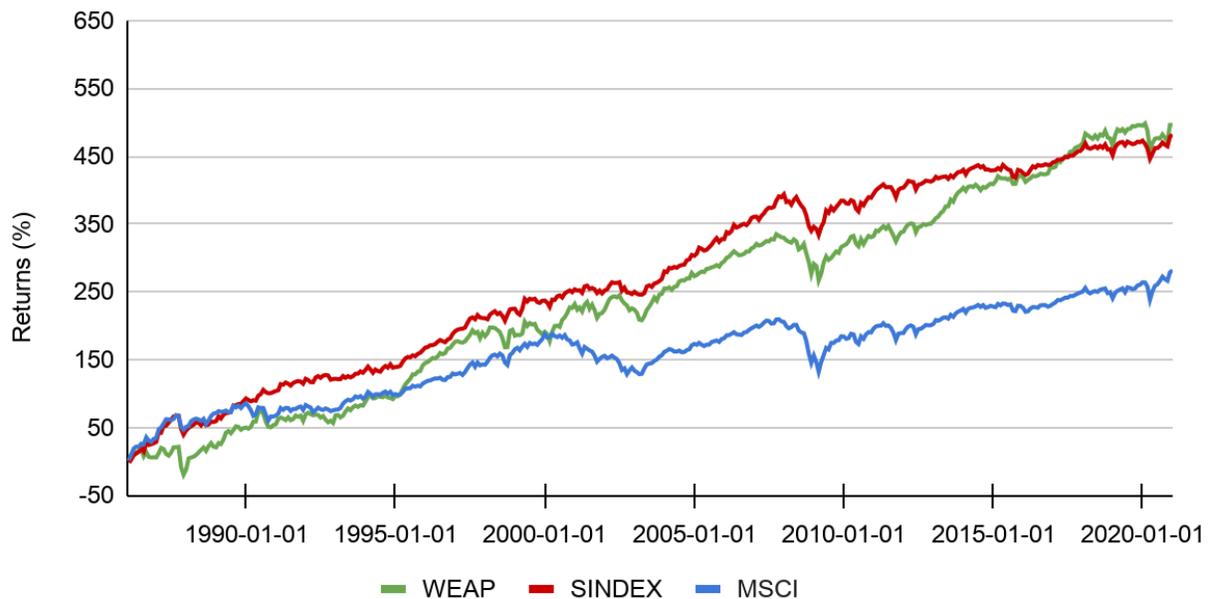


3.3.4 Weapons and Defence Industry

Figure 14 provides the compounded returns of the entire sin stock portfolio (SINDEX), the market portfolio (MSCI) and the weapons and defence portfolio (WEAP), for the entire sample time period. In this, we see that the weapons and defence portfolio actually underperforms the sin stock portfolio throughout a majority of the time period, even underperforming the market up until about 1995. This is further strengthened by the results in Table 7 and 9, revealing that the weapons and defence portfolio only succeeds to surpass SINDEX' Sharpe ratio in the third crisis, otherwise underperforming regarding returns per unit of assumed risk. In the results shown in Table 8, we see that the weapons and defence portfolio exhibits no significant dependency on Jensen's Alpha, thus there is no evidence for abnormal excess returns during any of the crisis periods. Furthermore, its market Beta fluctuated quite dramatically, suggesting very strong recession resistance in the two initial crisis periods. However, in crisis three and five we see that the weapons and defence industry can be almost as volatile as the market, even surpassing it in the most recent crisis period, with an highly significant estimated Beta of 1.36. Indicating that these kinds of stocks might be receiving more neglect from investors in recent years than prior crisis periods. Additionally, the regressionary results only estimate one significant dependency amongst all other input variables, the Fama and French investment factor. A dependency that is estimated to be highly negatively significant.

Figure 14

Compounded returns for SINDEX, MSCI and WEAP

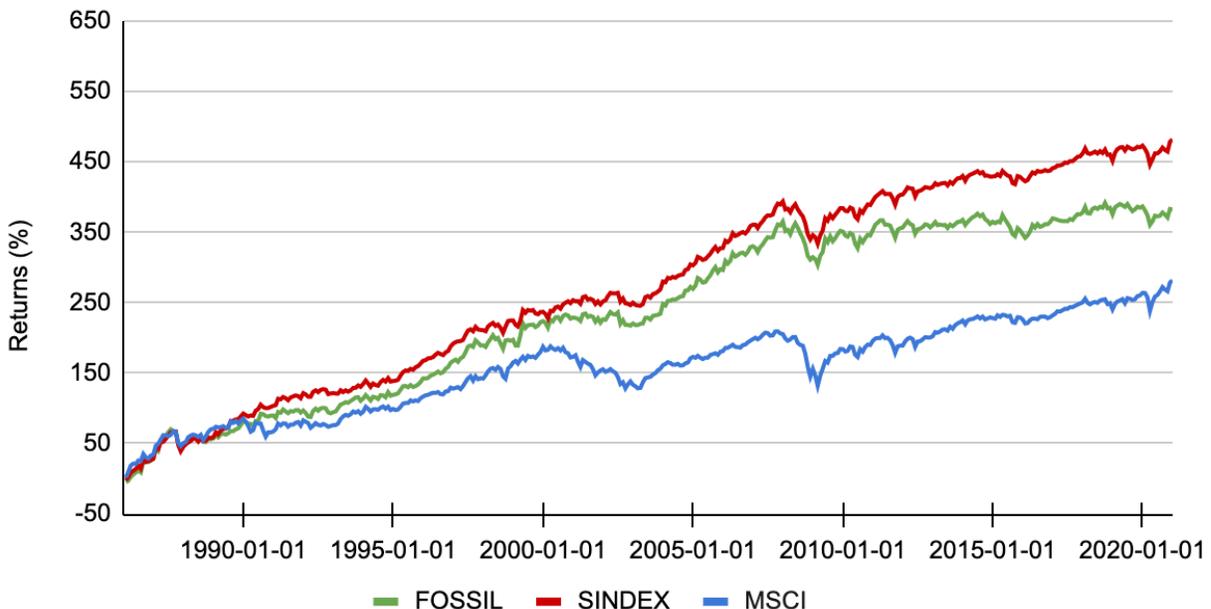


3.3.5 Fossil Fuels Industry

Figure 15 illustrates the compounded returns of the sin stock portfolio (SINDEX), the market portfolio (MSCI) and the fossil fuels portfolio (FOSSIL), during the entire sample period. Note that up until about 1990, fossil fuel stocks performed about on par with both the market and the sin stock portfolio. After that point they retain their outperformance relative to the market portfolio, but lose out to the sin stock portfolio. This underperformance relative SINDEX remains until the end of our time period. In Table 8, we observe that the fossil fuel stock portfolio features a statistically significant Beta value throughout the whole time period. Of which, only the first two crisis periods are significantly different from 1. Which would indicate that the fossil fuels industry was recession resistant during 1986 and 2001, but eventually lost this defensiveness and have since been deemed approximately as volatile as the market, sometimes even more volatile. Furthermore, our regressions found no significant Jensen's Alpha, thus providing no proof that fossil fuel stocks would embody any abnormal excess returns. The dependencies that were found were to the BAB factor and the Fama and French profitability and investment factors, during the first, third and fifth crisis periods.

Accounting for assumed risk in Table 7 and 9, reveals that the fossil fuels portfolio fails to exceed the sin stock portfolio's Sharpe ratio in all time periods. Indicating that fossil fuels are not as profitable as the constructed SINDEX, while also being less profitable per unit of assumed risk.

Figure 15
Compounded returns for SINDEX, MSCI and FOSSIL



3.3.6 Cannabis Industry

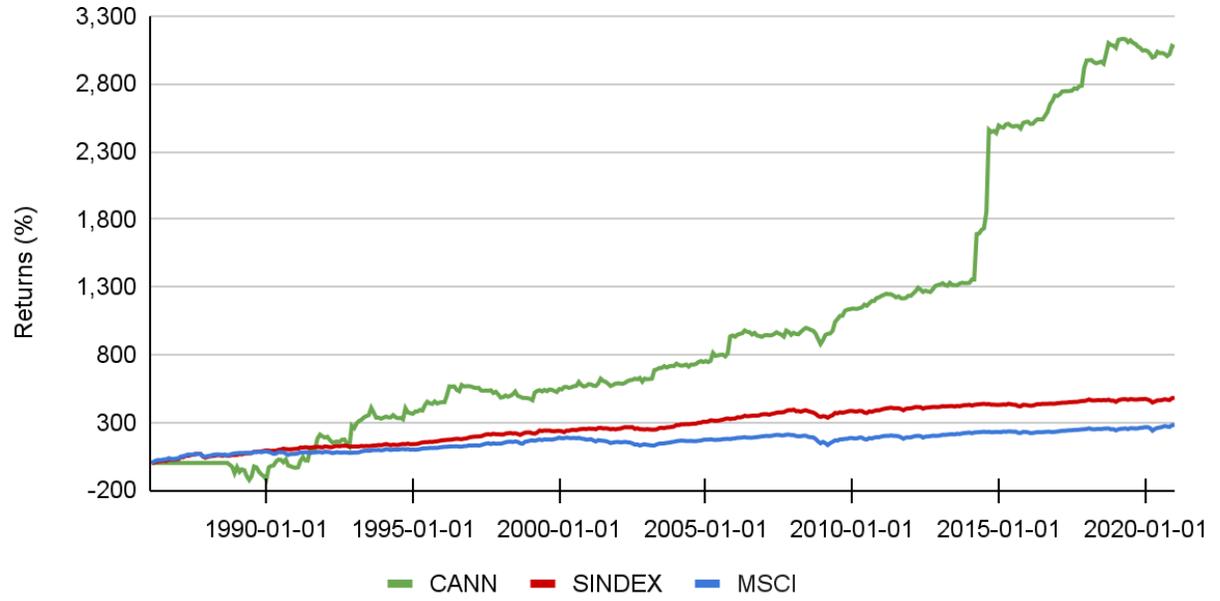
Figure 16 depicts the compounded returns of the entire sin stocks portfolio (SINDEX), the market portfolio (MSCI) and the cannabis portfolio (CANN), for the whole time period. Observe that the cannabis portfolio underperformed both SINDEX and the market portfolio up until about 1992. This can partly be explained by the fact that very few cannabis companies were listed this early in time. After this point, we see the cannabis portfolio outperforming both comparison portfolios and subsequently increasing the relative performance difference at a steady pace until 2015, when returns go through the roof, increasing by over 1000 percent.

Table 8 shows that the cannabis portfolio fails to exhibit significant market Betas in the first three crisis periods and Betas that are notably different from 1. Thus indicating that cannabis stocks are highly profitable and likewise very volatile and recession sensitive compared to the market. Additionally, none but the fourth crisis period showed a highly significant and positive Jensen's Alpha. Providing no real proof that there would be any significant abnormal excess returns associated with cannabis stocks under market downturns. This was also the same time period which exhibited the only significant dependency on any of the input variables, this case being the BAB factor. The extremely high returns of cannabis stocks are thus very loosely explained by the models utilized in this regression. It may very well be that these models fail to include exposure to any relevant factor, or it may just be that there is a certain kind of "hype" surrounding cannabis stocks and no strategic rhyme or reason behind growth and investment frequency.

Looking at Table 9, we find that the cannabis portfolio has a significantly lower Sharpe ratio than SINDEX in the first two crisis periods. However, during the latter three periods, cannabis stocks exhibit significantly higher Sharpe ratios. Providing evidence that cannabis stocks, during recent downturns, have had very large returns per unit of assumed risk.

Figure 16

Compounded returns for SINDEX, MSCI and CANN



4. Conclusion

This study utilized four conventional capital asset pricing models; CAPM, Fama and French Three-factor Model, Carhart Four-factor Model and Fama and French Five-factor model, with added input variables and Sharpe ratios. With the aim to study and identify potential performance differences between a portfolio with high exposure to sin industries and the market, as well as different comparable investment strategies. Of which, market defensiveness (i.e. asset recession resistance) is of most interest. Different regression windows and sub-regressions are employed to identify changes in investor behavior, portfolio performance over time and dependency on the market during different restricted time periods.

Based on our results, this study provides compelling evidence in favor of sin stocks being less volatile (i.e. more defensive) than the market (MSCI World), both in general and during most crisis periods, with a highly significant Beta value less than 1. However, comparing sin stocks to the SRI stock portfolio; SRINDEX and the saint stock portfolio; SAINTDEX, were found to be less volatile than SAINTDEX but more volatile than SRINDEX. Consistent with some prior literature like; Fabozzi et al. (2008), Hong and Kacperczyk (2009), Salaber (2009) and Troberg (2016), this paper showed evidence indicating that sin stocks earn abnormal returns. But a significant Alpha value was not a unique attribute amongst portfolios. Rather, most portfolios exhibited significant abnormal returns during most regression periods. Thus, suggesting that these abnormal returns might be the results of missing exposure and explanatory power within the utilized models rather than the result of a market anomaly.

Overall, sin stocks were found to be a defensive and high performing option for investors attempting to hedge against market movements. However, socially responsible investing was found to be both more defensive and the highest risk-adjusted returns yielding investment strategy, for the entire sample period and a majority of crisis periods. As such, it is deemed by this study to be the better investment alternative and reflective of current investor attitudes.

Furthermore, this study found the alcohol, gambling and cannabis industries drawing the bulk of abnormal sin stock returns. The weapons and defence industry in addition to the fossil fuels industry showed the lowest risk-adjusted returns in the sin stock portfolio. Moreover, the spread in Sharpe ratios between sin industries was not wide. Sin is both profitable and defensive, but not as much as socially responsible investing in the current state of finance.

Appendix

Table 10

Complete list of selected stocks

SINDEX	SRINDEX	SAINTDEX
Alcohol	Agriculture	3M
KWEICHOW MOUTAI CO LTD-A	INVERSORA JURAMENTO SA	ACCENTURE
WULIANGYE YIBIN CO LTD-A	NORWAY ROYAL SALMON ASA	ARCHER-DANIELS-MIDLAND
ANHEUSER-BUSCH INBEV SA/NV	BUMITAMA AGRI LTD	AECOM
DIAGEO PLC	FGV HOLDINGS BHD	AFLAC
HEINEKEN NV	MUYUAN FOODS CO LTD	ALLIANZ SE
LUZHOU LAOJIAO CO LTD-A	SCALES CORPORATION LTD	APTIV PLC
SHANXI XINGHUACUN FEN WINE-A	JAPFA LTD	AT&T
PERNOD RICARD SA	COSTA GROUP HOLDINGS LTD	AVANGRID INC
CONSTELLATION BRANDS INC-A	FORFARMERS NV	AVISTA
AMBEV SA	INGHAMS GROUP LTD	AVON RUBBER PLC
JIANGSU YANGHE BREWERY -A	SIME DARBY PLANTATION BHD	BEST BUY CO INC
BUDWEISER BREWING CO APAC LT	UNITED MALT GROUP LTD	BANK OF MONTREAL
BROWN-FORMAN CORP-CLASS B	CORTEVA INC	BOOZ ALLEN HAMILTON HOLDING CORP
CARLSBERG AS-B	AQUABOUTY TECHNOLOGIES INC	CANON INC
CHINA RESOURCES BEER HOLDING	NEW HOPE LIUHE CO LTD	CAPGEMINI SE
ANHUI GUJING DISTILLERY CO-A	ANDERSONS INC	CAPITAL POWER CORP
TSINGTAO BREWERY CO LTD-A	CALAVO GROWERS INC	CBRE GROUP INC
BOSTON BEER COMPANY INC-A	SANDERSON FARMS INC	COLGATE PALMOLIVE CO
TURK TUBORG BIRA VE MALT	VILMORIN & CIE SA	COOPER-STANDARD HOLDINGS INC
HANOI BEER ALCOHOL & BEVERAG	AUSTRALIAN AGRICULTURAL COMPANY LTD	CUMMINS INC
LAURENT-PERRIER	GRAINCORP LTD	DELL TECHNOLOGIES INC
BARON DE LEY	RIDLEY CORPORATION LTD	EATON CORPORATION PLC
MALTERIES FRANCO-BELGES	TASSAL GROUP LTD	ECOLAB INC
GANSU HUANGTAI WINE-MARKET-A	SELECT HARVESTS LTD	EDP ENEGIAS DE PORTUGAL SA
KOPPARBERGS BRYGGERI AB-B	ORIGIN ENTERPRISES PLC	EDWARDS LIFESCIENCES CORP
ALTIA CORP	KWS SAAT SE & CO KGAA	ELEKTA AB
CITIC GUOAN WINE CO LTD-A	FIRST RESOURCES LTD	ELI LLLY AND CORP

NAMIBIA BREWERIES LTD	GOLDEN AGRI-RESOURCES LTD	FIFTH THIRD BANCORP
VINA SAN PEDRO S.A.	CARLOS CASADO SA	FRESNILLO PLC
CORBY SPIRIT AND WINE LTD	SA SAN MIGUEL AGICI Y F	FRONTERA ENERGY CORP
ANDREW PELLER LTD -A	FRESH DEL MONTE PRODUCE INC	ARTHUR J GALLAGHER & CO
ARCUS ASA	TERRA SANTA AGRO SA	GENERAL MOTORS CO
FUJIAN YANJINGHUIQUAN BREW-A	SLC AGRICOLA SA	GENPACT LTD
SIMONDS FARSONS CISK	CHAODA MODERN AGRICULTURE HOLDINGS LTD	GRUPO BIMBO SAB DE CV
INTERNATIONAL BREWERIES	TONGWEI CO LTD	HANESBRANDS INC
GINEBRA SAN MIGUEL INC	ASTRA AGRO LESTARI TBK PT	HASBRO INC
KULMBACHER BRAUEREI AG	ASTRAL FOODS LTD	HCA HEALTHCARE INC
YOMEISHU SEIZO CO LTD	AUSTEVOLL SEAFOOD ASA	HENRY SCHEIN INC
ITALIAN WINE BRANDS SPA	AUSTRAL GROUP SAA	HEWLETT PACKARD ENTERPRISE CO
GUSBOURNE PLC	CHAROEN POKPHAND FOODS PCL	HONEYWELL INTERNATIONAL INC
SILVER BASE GROUP HOLDINGS	GFPT PCL	HP INC
SAN MIGUEL BREWERY HK LTD	GRIEG SEAFOOD ASA	HUBBELL INC
MIGHTY CRAFT LTD	IOI CORPORATION BHD	IBERDROLA SA
CHAMPION BREWERIES PLC	KERNEL HOLDING S.A.	INGREDION INC
WINE'S LINK INTERNATIONAL HO	KUALA LUMPUR KEPONG BHD	INTEL CORP
PRODVINALCO SA	LEROY SEAFOOD GROUP ASA	INTERNATIONAL BUSINESS MACHINES CORP
SAIGON BEER WESTERN JSC	MOWI ASA	INTERNATIONAL PAPER CO
BIG ROCK BREWERY INC	QL RESOURCES BHD	JONES LANG LASALLE INC
KTIMA KOSTAS LAZARIDIS S.A.	RCL FOODS LTD	DEERE & CO
DIAMOND ESTATES WINES & SPIR	SALMAR ASA	JOHNSON CONTROLS INTERNATIONAL PLC
SAVOR LTD	SANFORD LTD	KAO CORP
VINARSKA VIZBA TIKVES SKOPJE	OCEANA GROUP LTD	KELLOGG CO
SOM DISTILLERIES & BREWERIES	ELDERS LTD	KIMBERLY-CLARK CORP
NATIONAL BREWERIES PLC	GENTING PLANTATIONS BHD	KOHL'S CORP
AKTIENBRAUEREI KAUFBEUREN AG	ASIAN CITRUS HOLDINGS LTD	L'OREAL SA
BODEGAS RIOJANAS SA	PILGRIMS PRIDE CORP	LEIDOS HOLDINGS INC
LANDSHUTER BRAUHAUS AG PRIVA	P/F BAKKAFROST	LINCOLN ELECTRIC HOLDINGS INC
GRACE WINE HOLDINGS LTD	Pharmaceuticals	LINDE PLC
MARASKA DD ZADAR	OTSUKA HOLDINGS CO LTD	MANPOWER INC
Tobacco	ZOETIS INC	MASTERCARD INC

BULGARTABAK HOLDING	INDIVIOR PLC	NATURA & CO HOLDINGS SA
AUSTRALIS CAPITAL INC	PHARMA MAR SA	MICROSOFT CORP
SOC IVOIRIENNE DES TABACS	HANSOH PHARMACEUTICAL GROUP COMPANY LTD	NATIONAL GRID PLC
PHILIP MORRIS CR AS	CHINA SHINEWAY PHARMACEUTICAL GROUP LTD	NEXTERA ENERGY INC
SCANDINAVIAN TOBACCO GROUP A	GILEAD SCIENCES INC	NOKIA OYJ
EASTERN CO SAE	PERRIGO COMPANY PLC	OLD NATIONAL BANCORP
BRITISH AMERICAN TOBACCO PLC	VERTEX PHARMACEUTICALS INC	ON SEMICONDUCTOR CORP
IMPERIAL BRANDS PLC	VIATRIS INC	OSHKOSH CORP
GREENLANE HOLDINGS INC - A	IPSEN SA	XCEL ENERGY
KARELIA TOBACCO CO. S.A.	VIRBAC SA	WORKDAY
CHINA TOBACCO INTERNATIONAL	SANOFI SA	WEYERHAUSER
BENTOEL INTL INVESTAMA PT	VIFOR PHARMA AG	WESTERN DIGITAL
GUDANG GARAM TBK PT	SIEGFRIED HOLDING AG	WIPRO
HM SAMPOERNA TBK PT	CSL LTD	WM
WISMILAK INTI MAKMUR TBK PT	ASTRAZENECA PLC	VOYA FINANCIAL
INDONESIAN TOBACCO TBK PT	HIKMA PHARMACEUTICALS PLC	VISA
GLOBRANDS LTD	GLAXOSMITHKLINE PLC	VF
ITC LTD	MERCK KGAA	UNUM
GODFREY PHILLIPS INDIA LTD	BAYER AG	US BANK
VST INDUSTRIES LTD	CIPLA LTD	TIMKEN
KOTHARI PRODUCTS LTD	DR.REDDY'S LABORATORIES LTD	ALLSTATE
NTC INDUSTRIES LTD	DIVI'S LABORATORIES LTD	AES
GOLDEN TOBACCO LTD	GLENMARK PHARMACEUTICALS LTD	TERADATA
CARRERAS LTD	TAKEDA PHARMACEUTICAL CO LTD	TE CONNECTIVITY
AL EQBAL CO FOR INVESTMENT P	ASTELLAS PHARMA INC	TATA STEEL
UNION TOBACCO & CIGARETTE	SHIONOGI & CO LTD	STARBUCKS
JAPAN TOBACCO INC	DAIICHI SANKYO CO LTD	SONY GROUP CORP
KT&G CORP	EISAI CO LTD	SCHNITZER
SMOORE INTERNATIONAL HOLDING	KYOWA KIRIN CO LTD	SCHNEIDER ELECTRIC
CEYLON TOBACCO CO PLC	CHUGAI PHARMACEUTICAL CO LTD	SALES FORCE
TUTUNSKI KOMBINAT AD	SUMITOMO DAINIPPON PHARMA CO LTD	ROYAL CARIBBEAN GROUP
ALTRIA GROUP INC	ONO PHARMACEUTICAL CO LTD	ROCKWELL AUTOMATION

PAKISTAN TOBACCO CO LTD	RECORDATI INDUSTRIA CHIMICA E FARMACEUTICA SPA	REALOLOGY
KHYBER TOBACCO CO LTD	SWEDISH ORPHAN BIOVITRUM AB (PUBL)	PRUDENTIAL
PHILIP MORRIS PAKISTAN LTD	NOVO NORDISK A/S	PRINCIPAL
PHILIP MORRIS INTERNATIONAL	ABBOTT LABORATORIES	PREMIER
DUVANSKA INDUSTRIJA AD BUJAN	BRISTOL-MYERS SQUIBB CO	ORLEN
COKA DUVANSKA INDUSTRIJA AD	CARDINAL HEALTH INC	PEPSICO
PHILIP MORRIS OPERATIONS AD	JOHNSON & JOHNSON	PAYCHEX
SWEDISH MATCH AB	MERCK & CO INC	PARSONS
TURNING POINT BRANDS INC	PFIZER INC	OWENS CORNING
WEST INDIAN TOBACCO CO LTD	HYPERA SA	HELLENIC TELECOMMUNICATIONS ORGANIZATION
TANZANIA CIGARETTE CO LTD	SHANGHAI FOSUN PHARMACEUTICAL GROUP CO LTD	
UNIVERSAL CORP/VA	JOINCARE PHARMACEUTICAL GROUP INDUSTRY CO LTD	
VECTOR GROUP LTD	ASPEN PHARMACARE HOLDINGS LTD	
CAT LOI JSC	BAUSCH HEALTH COMPANIES INC	
NGAN SON JSC	KRKA DD NOVO MESTO	
VI NA TA BA TRADING & INVEST	NOVARTIS AG	
22ND CENTURY GROUP INC	ORION OYJ	
Gambling	ROCHE HOLDING AG	
KANGWON LAND INC	TEVA PHARMACEUTICAL INDUSTRIES LTD	
SUMMIT ASCENT HOLDINGS LTD	UCB SA	
WYNN MACAU LTD	LABORATORIOS FARMACEUTICOS ROVI SA	
SANDS CHINA LTD	GENOMMA LAB INTERNACIONAL SAB DE CV	
MGM CHINA HOLDINGS LTD	ADCOCK INGRAM HOLDINGS LTD	
GALAXY ENTERTAINMENT GROUP L	Soft Drinks	
REXLOT HOLDINGS LTD	COCA COLA HBC AG	
GENTING HONG KONG LTD	SUNTORY BEVERAGE & FOOD LTD	
AGTECH HOLDINGS LTD	FEVERTREE DRINKS PLC	
SJM HOLDINGS LTD	OSOTSPA PCL	
888 HOLDINGS PLC	JDE PEETS NV	

BET-AT-HOME.COM AG	NEWAGE INC
PLAYAGS INC	LOTTE CHILSUNG BEVERAGE CO LTD
ARISTOCRAT LEISURE LTD	UNI-PRESIDENT CHINA HOLDINGS LTD
ANGLER GAMING PLC	COCA-COLA BOTTLERS JAPAN HOLDINGS INC
BETMAKERS TECHNOLOGY GROUP L	ITO EN LTD
BETSSON AB	COCA-COLA CONSOLIDATED INC
BRAGG GAMING GROUP INC	FARMER BROS CO
BOYD GAMING CORP	MONSTER BEVERAGE CORP
CHURCHILL DOWNS INC	COCA-COLA AMATIL LTD
CENTURY CASINOS INC	ARCA CONTINENTAL SAB DE CV
CANTERBURY PARK HOLDING CORP	COCA-COLA FEMSA SAB DE CV
CAESARS ENTERTAINMENT INC	FOMENTO ECONOMICO MEXICANO SAB DE CV
DRAFTKINGS INC - CL A	A.G.BARR PLC
DONACO INTL LTD	BRITVIC PLC
ENTAIN PLC	TATA CONSUMER PRODUCTS LTD
EVOLUTION GAMING GROUP	COCA-COLA EUROPEAN PARTNERS PLC
SOCIETE FERMIERE DU CASINO	COCA-COLA CO
LA FRANCAISE DES JEUX SAEM	PEPSICO INC
FULL HOUSE RESORTS INC	VITASOY INTERNATIONAL HOLDINGS LTD
FLUTTER ENTERTAINMENT PLC-DI	CHINA FOODS LTD
GOLDEN NUGGET ONLINE GAMING	EMBOTELLADORA ANDINA SA
HIGHLIGHT EVENT AND ENTERTAI	PRIMO WATER CORP (MISSISSAUGA)
INTRALOT S.A.-INTEGRATED LOT	COCA-COLA ICECEK AS
KINDRED GROUP PLC	FRASER & NEAVE HOLDINGS BHD
LEOVEGAS AB	KEURIG DR PEPPER INC
LOTTO24	Recreational Services
PACIFIC ONLINE SYSTEMS CORP	SIX FLAGS ENTERTAINMENT CORP
LAS VEGAS SANDS CORP	SEAWORLD ENTERTAINMENT INC
MAGNUM BHD	LINDBLAD EXPEDITIONS HOLDINGS INC

MONARCH CASINO & RESORT INC
MGM RESORTS INTERNATIONAL
MELCO RESORTS & ENTERT-ADR
GROUPE PARTOUCHE SA-REGR
PENN NATIONAL GAMING INC
RGB INTERNATIONAL BHD
ROYAL INTERNATIONAL CORP
SPORTECH PLC
SUN INTERNATIONAL LTD
TABCORP HOLDINGS LTD
ZEAL NETWORK SE
EVERGREEN GAMING CORP
TSOGO SUN GAMING LTD
WEBIS HOLDINGS PLC
PHILWEB CORP
WYNN RESORTS LTD

Weapon & Defense

BOEING CO/THE
RAYTHEON TECHNOLOGIES
CORP
LOCKHEED MARTIN CORP
AIRBUS SE
NORTHROP GRUMMAN CORP
GENERAL DYNAMICS CORP
L3HARRIS TECHNOLOGIES INC
TRANSDIGM GROUP INC
BAE SYSTEMS PLC
NATIONAL PRESTO INDS INC
RADA ELECTRONIC INDS LTD
SENIOR PLC
VECTRUS INC

DXB ENTERTAINMENTS PJSC
PLANET FITNESS INC
MADISON SQUARE GARDEN
SPORTS CORP
BASIC FIT NV
ARDENT LEISURE GROUP LTD
MADISON SQUARE GARDEN
ENTERTAINMENT CORP
PELTON INTERACTIVE INC
ONESPAWORLD HOLDINGS LTD
SHENZHEN OVERSEAS CHINESE
TOWN CO LTD
RCI HOSPITALITY HOLDINGS INC
COMPAGNIE DES ALPES SA
CINEWORLD GROUP PLC
BORUSSIA DORTMUND GMBH &
CO KGAA
ORIENTAL LAND CO LTD
JUVENTUS FC SPA
LIVE NATION ENTERTAINMENT
INC
DRIVE SHACK INC

Industrial Engineering

NORMA GROUP SE
HYSTER-YALE MATERIALS
HANDLING INC
KION GROUP AG
VALMET OYJ
FINCANTIERI SPA
EPIROC AB
DOOSAN HEAVY INDUSTRIES &
CONSTRUCTION CO LTD
DOOSAN INFRACORE CO LTD
LINCOLN ELECTRIC HOLDINGS
INC
WOODWARD INC
MEYER BURGER TECHNOLOGY
AG
GEORG FISCHER AG

ELECTRO OPTIC SYSTEMS HOLDIN	SCHINDLER HOLDING AG
VSE CORP	SULZER AG
HARBIN XINGUANG OPTIC-ELEC-A	RIETER HOLDING AG
CESKA ZBROJOVKA GROUP SE	WEIR GROUP PLC
ASTRONICS CORP	VESUVIUS PLC
AUTONOMOUS CONTROL SYSTEMS L	DEUTZ AG
HUAXUN FANGZHOU CO LTD-A	GEA GROUP AG
VICTEK CO LTD	HEIDELBERGER DRUCKMASCHINEN AG
AEROSTAR SA BACAU	AIA ENGINEERING LTD
I3SYSTEM INC	CUMMINS INDIA LTD
APPLIED ENERGETICS INC	THK CO LTD
AIIT ONE CO LTD	EBARA CORP
NATIONAL AEROSPACE FASTENERS	KOMATSU LTD
ZEN TECHNOLOGIES LTD	HITACHI CONSTRUCTION MACHINERY CO LTD
ASHOT -ASHKELON INDUSTRIES	SUMITOMO HEAVY INDUSTRIES LTD
CPI AEROSTRUCTURES INC	KUBOTA CORP
APOLLO MICRO SYSTEMS LTD	AMADA CO LTD
XTEK LTD	NABTESCO CORP
SAAB AB	GLORY LTD
H&K AG	MITSUBISHI HEAVY INDUSTRIES LTD
SMITH & WESSON	YASKAWA ELECTRIC CORP
STURM RUGER	BIESSE SPA
VISTA OUTDOOR	DANIELI & C OFFICINE MECCANICHE SPA
AMMO INC.	AMG ADVANCED METALLURGICAL GROUP NV
AMERICAN OUTDOOR	ATLAS COPCO AB
Fossil Fuels	TRELLEBORG AB
SAUDI ARABIAN OIL CO	AGCO CORP
EXXON MOBIL CORP	ALAMO GROUP INC
CHEVRON CORP	BRUNSWICK CORP
RELIANCE INDUSTRIES LTD	CATERPILLAR INC
ROYAL DUTCH SHELL PLC-A SHS	CUMMINS INC

TOTAL SE	DEERE & CO
PETROCHINA CO LTD-H	KADANT INC
BP PLC	ENPRO INDUSTRIES INC
ENBRIDGE INC	TEREX CORP
CHINA PETROLEUM & CHEMICAL-H	TENNANT CO
ROSNEFT OIL CO PJSC	TORO CO
GAZPROM PJSC	WEG SA
CONOCOPHILLIPS	ANDRITZ AG
EQUINOR ASA	PALFINGER AG
CHINA SHENHUA ENERGY CO-H	FERREYCORP SAA
PETROBRAS - PETROLEO BRAS-PR	KONE OYJ
NOVATEK PJSC	OC OERLIKON CORPORATION AG
LUKOIL PJSC	PFAEFFIKON
ENTERPRISE PRODUCTS PARTNERS	METSO OUTOTEC CORP
TC ENERGY CORP	TOMRA SYSTEMS ASA
NESTE OYJ	UNITED TRACTORS TBK PT
SHANDONG MOLONG PETROLEUM-H	WARTSILA OYJ ABP
SHANGHAI LONYER FUELS CO L-A	SHANGHAI ELECTRIC GROUP CO LTD
CONSOL ENERGY INC	WEICHAI POWER CO LTD
COOPER ENERGY LTD	SANDVIK AB
BUMI RESOURCES TBK PT	HIWIN TECHNOLOGIES CORP
TOA OIL CO LTD	Renewable & Alternative Energy
NATIONAL PETROLEUM SERVICES	AMERESCO INC
NATIONAL REFINERY LTD	GCL SYSTEM INTEGRATION TECHNOLOGY CO LTD
CHINA OIL AND GAS GROUP LTD	ENPHASE ENERGY INC
STORM RESOURCES LTD	RENEWABLE ENERGY GROUP INC
MONGOLIAN MINING CORP	SUNGROW POWER SUPPLY CO LTD
INDEPENDENT PETROLEUM GROUP	XINYI SOLAR HOLDINGS LTD
MJL BANGLADESH LTD	CHINA CONCH VENTURE HOLDINGS LTD
TRINIDAD & TOBAGO NGL-CL B	SCATEC ASA
HANKOOK SHELL OIL CO LTD	SOLAREEDGE TECHNOLOGIES INC
	SIF HOLDING NV

PETRON MALAYSIA REFINING & M	TPI COMPOSITES INC
PANORO ENERGY ASA	SIEMENS ENERGY AG
HIBISCUS PETROLEUM BHD	XINJIANG GOLDWIND SCIENCE & TECHNOLOGY CO LTD
NAVITAS PETROLEUM LP	AMERICAN SUPERCONDUCTOR CORP
AFRICA ENERGY CORP	FIRST SOLAR INC
NEXTDECADE CORP	FUELCELL ENERGY INC
TOUCHSTONE EXPLORATION INC	GREEN PLAINS INC
CARDINAL ENERGY LTD	SUNPOWER CORP
SUZHOU DOUSON DRILLING & P-A	PLUG POWER INC
SOUTHERN KUZBASS PJSC	ITM POWER PLC
NIPPON COKE & ENGINEERING CO	CERES POWER HOLDINGS PLC
BARAMULTI SUKSESSARANA TBK P	CENTROTHERM INTERNATIONAL AG
NGL ENERGY PARTNERS LP	CROPENERGIES AG
GOLDEN ENERGY & RESOURCES LT	NORDEX SE
TBS ENERGI UTAMA TBK PT	VERBIO VEREINIGTE BIOENERGIE AG
TONG PETROTECH CORP-A	SUZLON ENERGY LTD
EPSILON ENERGY LTD	REX AMERICAN RESOURCES CORP
CANADIAN OVERSEAS PETROLEUM	ABENGOA SA
CWC ENERGY SERVICES CORP	SIEMENS GAMESA RENEWABLE ENERGY SA
HURRICANE ENERGY PLC	SOLARIA ENERGIA Y MEDIO AMBIENTE SA
SOUTHERN ENERGY HOLDINGS GRO	GCL-POLY ENERGY HOLDINGS LTD
MONGOLIA ENERGY CORP LTD	PEED TRANSMISSION EQUIPMENT G
BAHAMAS PETROLEUM CO PLC	MOTECH INDUSTRIES INC
Cannabis	BALLARD POWER SYSTEMS INC
48NORTH CANNABIS CORP	NEL ASA
RADIANT TECHNOLOGIES INC	SUPER ENERGY CORPORATION PCL
ORGANIGRAM HOLDINGS INC	VESTAS WIND SYSTEMS A/S
APHRIA INC	CHINA LONGYUAN POWER GROUP CORP LTD

BODY AND MIND INC
MATICA ENTERPRISES INC
CRONOS GROUP INC
BIOME GROW INC
HEXO CORP
EVE & CO INC
TRUE LEAF BRANDS INC
FIORE CANNABIS LTD
SATIVA WELLNESS GROUP INC
GROWN ROGUE INTERNATIONAL
INC
RUBICON ORGANICS INC
HIGH TIDE INC
LITTLE GREEN PHARMA LTD
CLEVER LEAVES HOLDINGS INC
SUNDIAL GROWERS INC
TILRAY INC
FIRE & FLOWER HOLDINGS CORP
GREEN ORGANIC DUTCHMAN
HOLDINGS LTD
IGNITE INTERNATIONAL BRANDS
LTD
DECIBEL CANNABIS COMPANY
INC
AURORA CANNABIS INC
VALENS COMPANY INC.
CHOOM HOLDINGS INC
VIVO CANNABIS INC
SUPREME CANNABIS COMPANY
INC
FLOWER ONE HOLDINGS INC
DELTA 9 CANNABIS INC
INDVR BRANDS INC.
1933 INDUSTRIES INC
HERITAGE CANNABIS HOLDINGS
CORP
CANOPY GROWTH CORPORATION
ZYNTERBA PHARMACEUTICALS

MYM NUTRACEUTICALS INC

All stocks were initially screened in Bloomberg Terminal with the help of the ICB system and all data was then extracted from Thomson Reuter's Datastream.

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