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The Growth of Socially Responsible Investing Practices in U.S. Equity Markets and Abnormal Sin Stock Returns

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The Growth of Socially Responsible Investing in U.S. Equity Markets and Abnormal Sin Stock Returns

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Abstract

In my Senior Thesis, I explore the growth of socially responsible investing (SRI) practices in U.S. equity markets and abnormal sin stocks returns. I analyze the historical performance of socially responsible ETFs and portfolios of current sin stocks—alcohol, tobacco, gaming, and aerospace & defense stocks. I propose that as socially responsible investing practices continue to grow in U.S. equity markets, more industries will eventually be deemed sinful—such as sugary beverages, fast food/sugary food, biotech & pharmaceuticals, and tech/social media. I examine two sinful industries—alcohol and tobacco—by comparing the performance of these sinful portfolios before and after their industries were widely perceived as sinful.

I explored these topics for a few key reasons. First, socially responsible investing practices in U.S. equity markets have exploded in popularity over the last decade. Every year, we see increasing amounts of money screened for environmental, social and governance (ESG) factors. Despite its increase in popularity, many people have claimed that socially responsible investing isn't financially responsible investing—it underperforms as compared to common benchmarks such as the S&P 500. On the other hand, existing literature has supported the claim that investing in sin stocks generates abnormal returns for investors. I hypothesize that these two areas of portfolio management are connected—as socially responsible investing practices continue to grow, more industries will eventually be widely perceived as sinful. If the sin stock anomaly does exist and portfolios of sin stocks do generate abnormal returns, individuals and institutions can benefit from an immediate and long term investment strategy by investing in these "future" sinful industries now.

Using three distinct capital asset pricing models—the Fama-French 3 Factor Model, the Fama-French 3 Factor Model plus Momentum, and the Fama-French 5 Factor Model—I come to four main conclusions. First, investing in socially responsible ETFs does not generate positive

abnormal returns; in some instances, it generates statistically significant negative abnormal returns. Second, across the Fama-French 3 Factor Model, the Fama-French 3 Factor Model plus Momentum, and the Fama-French 5 Factor Model, portfolios of sin stocks from 1977-2018 generate statistically significant positive abnormal returns. Third, during the same time horizon, portfolios of future sin stocks exhibit similar levels of abnormal returns, especially portfolios of biotech & pharmaceutical stocks and portfolios of tech/social media stocks. Finally, portfolios of alcohol and tobacco stocks generated statistically significant abnormal returns after being widely perceived as sinful as compared to before they were widely perceived as sinful.

My research has implications for practicing portfolio managers. First, socially responsible investing isn't financially responsible investing. Second, portfolio managers should consider how the growth of socially responsible investing practices will impact perceptions of what is sinful. Anticipating which industries will become sinful can yield a profitable investment strategy. Third, I promote a profitable investment strategy in the short- and long-term time horizon. The results are clear: go long on sin and short on SRI.

Key Words: Sin, ESG, ETF, VICEX, Fama-French, Tobacco

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1. Introduction

The growth of socially responsible investing (SRI) practices in U.S. equity markets focuses on screening potential investment choices for environmental, social and governance (ESG) factors. Some of these factors include the percentage of women in the C-suite, how diverse and inclusive a company is, or the amount of carbon emissions produced by the company on an annual basis. At its core, SRI focuses on screening investment choices for morally and ethically sound factors. On the other end of the moral and ethical spectrum are sin stocks. Sin stocks are stocks of companies that produce or provide a good or service that is deemed morally problematic by investors. The most common kind of sin stocks are the "triumvirate of sin," which include alcohol, tobacco, and gaming stocks. Similarly, aerospace & defense stocks have been grouped in with the "triumvirate of sin" as a key sinful industry. This has been due to the increasing tension in the U.S. over the right to bear arms and the U.S.'s usage of advanced military technology, such as drones. These two areas of portfolio management couldn't be more different; the growth of SRI in U.S. equity markets focuses on screening potential investments for moral and ethical traits while sin stocks exhibit immoral and unethical traits.

These two topics question basic portfolio management theory. Most portfolio management theories assume that the investor wants to maximize their own utility. As we learned in our portfolio management class last spring, the investor must make two decisions—how much to invest in a risk-free vs. a risky portfolio and how much to invest in each type of risky asset in the risky portfolio. The mean-variance utility model states

that the utility of the investor is equal to the expected return on the portfolio minus one-half risk aversion parameter times the variance of the portfolio return. In this basic portfolio management-utility model, we consider the expected return of the portfolio, the variance of its return and the risk characteristics of the investor. This well-known and widely accepted model is challenged by SRI practices and sin stocks. SRI practices consider two things in portfolio construction; the mean-variance utility model *and* the moral and ethical convictions in portfolio construction. This truth raises a series of question about SRI practices. First, why should investors include their moral and ethical convictions in portfolio construction? Similarly, if investors do include their convictions in their utility model, how is investment performance affected? These challenges and questions are brought to investing in sin stocks as well. The mean-variance utility model includes nothing about moral and ethical convictions, but, should investors invest in companies that produce/provide a good/service that is deemed sinful? If so, how is investment performance affected?

According to the USSIF (The Forum for Sustainable and Responsible Investment), SRI practices in the U.S. are growing at a rapidly. In 2016, one of out every five dollars under professional management in the U.S. was screened for basic ESG factors—amounting to nearly $8.72 *trillion*. Similarly, in the last decade, sustainable investing has grown in a positive direction, excluding the financial crisis of 2008-2009.[1] This growth is exhibited in **Figure 1.** As institutions and investors have become more socially responsible in their investment choices, more industries have been perceived as

[1] "Report on U.S. Sustainable, Responsible, and Impact Investing Trends 2016," The Forum for Sustainable and Responsible Investing, accessed November 29, 2018, https://www.ussif.org/files/SIF_Trends_16_Executive_Summary(1).pdf.

sinful. The "triumvirate of sin" has grown from alcohol stocks, tobacco stocks, and gaming stocks to include aerospace & defense stocks, cannabis stocks and pornography stocks.

Even though SRI practices in U.S. equity markets have exploded in popularity over the past decade, there is an overwhelming amount of evidence that SRI underperforms common benchmarks, such as the S&P 500. For example, the S&P 500 has returned 9.4% over the past decade. In May 2018, the Wall Street Journal reported that eight representative ESG ETFs had a lower 10 year annualized total return than the SPDR S&P 500 ETF, and some ESG focused ETFs even had *negative* 10-year annualized returns.[2]

In contrast, portfolios of sin stocks have historically outperformed these common benchmarks. Most notably, Fabozzi, Ma, and Oliphant (2008) find that a sin stock anomaly exists and that portfolios of sin stocks generate positive alpha. In a key follow up analysis, Fabozzi and Blitz (2017) find that portfolios of sin stocks see lower levels of alpha in a Fama-French 3 Factor Model plus Momentum. As they add in different Fama-French factors, including profitability and investment, they find that the sin stock anomaly *doesn't* exist—implying these positive abnormal returns disappear.

This thesis contributes to the existing literature in four ways. First, I test the sin stock anomaly. In order to do this, I use regression models and Fama-French Factor Models. I created my portfolios of current sin stocks—alcohol, tobacco, gaming and aerospace & defense—by using Standard Industrialized Codes (SICs). These SICs are

[2] Dan Weil, "Do-Good Funds Finally Are Paying Off in Performance. Will It Last?" *New York Times,* May 2018.

used to denote different industry groupings; they automatically create portfolios of stocks based industries. In this part of my paper, I want to see the levels of alpha generated once these portfolios are regressed on the Fama-French factors. I also test the existence of a negative relationship between the level of alpha generated and the introduction of more Fama-French factors in my regression models. Prior academic papers tested the sin stock anomaly in different ways than me—such as creating portfolios of sinful industries by handpicking stocks. My robust portfolio construction using SIC codes provides a new way to test the existence of the sin stock anomaly.

Second, I assess whether socially responsible investing practices generate abnormal returns. In order to do this, I use regression models and Fama-French Factor Models. I compiled a list of socially responsible ETFs by isolating funds with an ESG focus. I aim to see the levels of alpha (if any) generated once they are regressed on the Fama-French factors and I want to see the levels of statistical significance associated with the levels of alpha generated. Furthermore, I aim to see if there is any kind of statistical performance that is driving the influx of money being screened for ESG factors.

Third, I examine portfolios of what I believe to be "future" sin stocks to see if they have generated positive alpha in the past. In order to do this, I use regression models and Fama-French Factor Models. I created my portfolios of "future" sin stocks in the same manner that I used to create portfolios of my current sin stocks—picking SIC codes that are most representative of the industry as a whole. In this part of my paper, I want to see if portfolios of "future" sin stocks generated alpha (if any) once regressed on the Fama-French factors. I am curious to see if these portfolios have generated alpha in the past. More importantly, if these portfolios have generated alpha in the past, I conjecture that

these portfolios have the potential to generate *larger* levels of alpha going forward once their industries are widely perceived as sinful by institutions and investors.

Fourth, I aim to address the hypothesis I develop in the third part of my paper—could portfolios of "future" sin stocks generate higher levels of alpha in the future once those industries are widely perceived as sinful by institutions and investors? While I cannot calculate future stock returns, nor can I say that these industries *will* become sinful, I can analyze the returns of portfolios of current sin stocks *before* and *after* an increase in the perceived sinfulness of the two industries. The most straightforward case studies involve looking at the tobacco industry and the alcohol industry in the U.S. The U.S. government put out damning information and passed crucial legislation showing the adverse health effects associated with alcohol and tobacco usage. I am curious to see if portfolios of tobacco stocks and alcohol stocks generated higher levels of alpha after they were perceived as sinful as compared to before they were perceived as sinful. If those portfolios do generate larger abnormal returns after their industries were perceived as sinful, it bolsters my argument and could highlight a significant investment strategy for the short-term and long-term time horizons. I hypothesize that my case studies will reveal that portfolios of alcohol and tobacco stocks after they were widely perceived as sinful will *outperform* portfolios of alcohol and tobacco stocks before they were widely perceived as sinful; this outperformance is the most crucial piece of evidence proving the existence of the sin stock anomaly.

This Thesis reaches four conclusions. First, socially responsible investing isn't *financially* responsible investing; socially responsible investing overall doesn't deliver positive abnormal returns and factoring your moral and ethical convictions in your

portfolio construction undermines your portfolio's performance. Second, in my sample from 1977 through 2018, my portfolios of current sin stocks generated positive and statistically significant levels of alpha across a series of factor models. Third, my portfolios of future sin stocks generated positive, and statistically significant levels of alpha across all factor models. My portfolios of biotech & pharmaceuticals stocks and tech/social stocks generated positive, and statistically significant levels of alpha across all factor models. My portfolios of sugary beverages stocks and fast food/sugary food generated positive, and statistically significant levels of alpha across all factor models (except the Fama-French 5 Factor Model). Fourth, I compared the performance of portfolios of alcohol and tobacco stocks before and after those industries were widely viewed as sinful. Portfolios of alcohol and tobacco stocks before they were widely perceived as sinful failed to generate positive and statistically significant levels of alpha. On the other hand, portfolios of alcohol and tobacco stocks after those industries were widely perceived as sinful generated positive, and statistically significant levels of alpha. These results help bolster the existence of the sin stock anomaly in U.S. equity markets. More importantly, these results reinforce the notion that once industries are widely perceived as sinful by institutions and investors, portfolios of these stocks generate positive, larger, and statistically significant levels of alpha as compared to portfolios of these stocks before they were widely perceived as sinful by institutions and individuals. This finding is crucial in bolstering my argument that as socially responsible investing continues to grow, more industries will be perceived as sinful and portfolios of those stocks will generate larger levels of excess returns than before they were perceived as sinful.

2. Literature Review

a. Sin Stock Literature Review

While the sin stock anomaly wasn't documented until the mid-2000s, theoretical foundations for the anomaly were provided much earlier. Becker (1957) claims that investors shouldn't factor in cultural norms into their mean-variance utility model. He argues that if investors discriminate against potential investment choices by incorporating social norms, they bear a financial cost in doing so. While Becker (1957) doesn't provide any data relating to SRI or sin stock performance, his model helps explain why SRI approaches could result in losing out on potential financial gains.

Similarly, Merton (1987) proposes a series of hypotheses and models that can be directly tied to sin stock performance. In his paper, he discusses the significance of neglected stocks and creates a model of market segmentation. According to Merton, neglected stocks are unpopular stocks. He claims that neglected stocks are not as heavily followed by professional analysts as other stocks. Consequently, the price of neglected stocks is always further from their true intrinsic value, creating significant price differentials. Essentially, neglected stocks are more valuable due to their lack of coverage. Furthermore, Merton (1987) proposes a model of market segmentation. He claims that there is an investable universe encompassing all publicly traded stocks. In his model, an investor will construct a portfolio with a given security, only if the investor knows about that given security. He bolsters his argument by claiming that there are

thousands of tradeable securities and that most portfolios contain only a fraction of them. If investors do not know about a security, they cannot add that security to their portfolio.

The first paper, and most significant paper, to analyze sin stock performance is Fabozzi, Ma and Oliphant (2008). They construct a portfolio of sin stocks. Their portfolio includes selected alcohol stocks, tobacco stocks, gaming stocks**,** defense stocks, adult services stocks and biotech stocks**.** They choose firms based on specific revenue breakdowns and product line offerings. They examine monthly stock returns from 1970-2007. Their portfolio of sin stocks generates an annual return of 19 percent. The alpha generated from their sinful portfolio outperforms their common benchmarks. Along with this finding, they highlight how their sinful portfolio had fewer years of generating a negative return as compared to their market benchmarks. The sinful portfolio produced negative returns in *two* years of the thirty-seven-year time horizon. On the other hand, their market benchmarks generated negative returns in *nine* of the thirty-seven-year time horizon.

The second most significant paper to explore the sin stock anomaly was written by Hong and Kacperczyk (2009). Their paper was different than Fabozzi, Ma and Oliphant (2008) because they proposed a trading strategy revolving around sin stocks. Using Fama-French industry groups, Hong and Kacperczyk execute their trading strategy—they take a long position on portfolios of sin stocks and they take a short position on portfolios of comparable stocks (stocks from Fama-French industry groups of food, fun, etc.) Using monthly stock returns over a forty-year time horizon, they found that their trading strategy generated 26 basis points per month when regressed on the Fama-French 3 Factor Model including the Momentum factor. They also analyze sin stock performance

in their study and find that sin stocks outperform their comparables by 29 basis points a month.

Adamsson and Hoepner (2015) re-examine the sin stock anomaly. Both authors are concerned with the main criticism that Hong and Kacperczyk's paper received—can abnormal returns be generated for the average investor by investing in sin stocks? In their study, they create equal-weighted sin portfolios and find that they generate alpha—like Hong and Kacperczyk (2009). However, they questioned the "ivory tower" data models that Hong and Kacperczyk (2009) created. Adamsson and Hoepner (2015) claim that equal-weighted portfolios of sinful industries are not easily investable for many institutional investors that have value-weighted benchmarks. Similarly, they believe equal-weighted portfolios were exposed to a small cap bias. They argue that if small cap firms outperform large cap firms, then an equal-weighted portfolio is likely to outperform its value-weighted equivalent. Once they create value-weighted portfolios of sin stocks, they find that these portfolios do not generate any abnormal returns—implying that the sin stock anomaly doesn't exist.

Richey (2016) generates portfolios of sinful industries by compiling daily stock returns from a twenty-nine year time horizon (October 1987-October 2016). He also creates one sinful portfolio that incorporates all of his defined sinful industries. He then uses a series of regression models—Jensen's Alpha, Fama-French 3 Factor Model, Carhart 4 Factor Model—also known as the Fama-French 3 Factor Model plus Momentum—and the Fama-French 5 Factor Model—to get a series of compelling results. In his study, he found that his sin portfolios exhibited a positive and significant alpha when regressed on the following models: Jensen's Alpha, Fama-French 3 Factor Model

and Carhart 4 Factor Model. On the other hand, when he regresses his sin portfolios on the Fama-French 5 Factor model, their levels of alpha decrease.

Blitz and Fabozzi (2017) revisit the most significant sin stock paper written—Fabozzi, Ma and Oliphant (2008). Over a decade later, the two men wanted to revisit the topic and apply new data models. They created a value weighted portfolio of alcohol, tobacco and weapons stocks by gathering monthly return data from Fama-French industry sectors of "beer," "smoke," and "guns." They collect monthly stock returns from July 1963-December 2016. Using time-series regression models, Blitz and Fabozzi (2017) establish the sin stock anomaly does exist when their portfolio was regressed on the classic size, value, and momentum factors. However, when they include the new Fama-French factors of profitability and investment in their time-series regression model, virtually no alpha is generated, signifying that the sin stock anomaly is explained by the portfolio's exposure to the most recent Fama-French factors.

All of these papers provide an interesting backdrop on the sin stock anomaly. Until 2015, numerous academic papers were published that confirmed the existence of it. However, in the past couple of years, numerous academic studies disprove the sin stock anomaly. They claim that by updating the Fama-French Factor Models to incorporate more variables, the sin stock anomaly disappears. Effectively, numerous academics have argued that the sin stock anomaly can be explained by these stocks exposure to more factors in capital asset pricing models.

b. Socially Responsible Investing Literature Review

Most academic papers cite the same author that was heavily cited to explain the sin stock anomaly: Thomas Merton (1987). Most academics who cite Thomas Merton refer to his ideas concerning neglected stocks and market segmentation. First, Merton (1987) suggests that stocks that have less institutional and individual following tend to be undervalued. Second, Merton (1987) claims in his model of market segmentation that you can only construct a portfolio of securities you know about. Unlike sin stocks, Merton's (1987) concepts adversely affect socially responsible investing practices. Because socially responsible investing practices with an ESG focus have exploded in popularity in U.S. equity markets, both institutions and individuals tend to be proactive with their investment choices, screening out investment choices that go against their moral and ethical beliefs. Consequently, socially responsible securities tend to be followed more than sin stocks—creating less potential true value for both institutions and investors. Similarly, Merton's (1987) model of market segmentation adversely affects socially responsible investing. As mentioned before, socially responsible investing practices have grown in popularity in U.S. equity markets and investing in sin stocks has become increasingly taboo in U.S. equity markets. People who screen their investment choices for ESG traits tend to have a smaller realm of investable securities. This focus on ESG traits is now becoming the norm. Effectively, the pool of socially responsible securities continues to get smaller with more investors following suit. On the other hand, the pool of sin stocks continues to get larger with fewer investors following suit because investing in morally hazardous companies has become increasingly taboo.

While socially responsible investing practices have exploded in popularity over the past two decades, it is interesting to note that its origins trace back to the 1960s and 1970s. In a research piece published by Blaine Townsend (2017) of Bailard Wealth Management, he analyzes the history of SRI practices and ESG focused investment strategies. Townsend (2017) notes that the 1960s were one of the most dynamic times in American history, where contemporary societal values were challenged aggressively. Issues regarding social justice, climate change, women's rights, and corporate governance became hot-button issues. Consequently, this led to the creation of the first mutual funds reflecting these sentiments in the 1970s. Similar to socially responsible investors today, investors in the 1970s felt compelled by principal and not by quantitative results—they believed that certain investments went against their core principals. Townsend (2017) argues that the biggest catalyst of SRI practices was the Vietnam War. As the war progressed, the U.S. population grew increasingly doubtful of our place in it and the U.S. population increasingly wanted to get out of it. Many contemporary investors understood that certain investment strategies would profit off war efforts and these investors avoided certain investment strategies.

Hamilton, Jo and Statman (1993) study the investment performance of socially responsible mutual funds. In their paper, they pose two questions. The first, "what are the alternative hypotheses about the expected relative returns of socially responsible mutual funds and conventional mutual funds?" The second, "what are the actual relative returns of socially responsible mutual funds and conventional mutual funds?"(Pg. 63) Similarly, they pose three alternative hypotheses about the relative return of socially responsible portfolios and their conventional counterparts. First, they hypothesize that the risk-

adjusted expected returns of a socially responsible portfolio equals the risk-adjusted expected returns of a conventional portfolio. This idea comes from the belief that stocks do not feature a price differential if they are socially responsible or not—for every socially responsible investor there is a conventional investor who doesn't care about socially responsible investing practices. Second, they hypothesize that the expected returns of a socially responsible portfolio will be less than the expected returns of a conventional portfolio. This idea comes from the belief that socially responsible investors impact stock prices, implying the market negatively prices the socially responsible characteristic. Third, they hypothesize that the expected returns of socially responsible portfolios will be greater than the expected returns of a conventional portfolio. This idea comes from the belief that investors who screen their investment choices for socially responsible traits will do better than the conventional investor who doesn't factor these traits at all. Using a series of regression models, the authors come to two conclusions. First, socially responsible mutual funds do not generate statistically significant levels of abnormal return. Second, the performance of socially responsible mutual funds is eerily comparable to the performance of conventional mutual funds. Essentially, the authors find that negative screening doesn't impact fund performance.

Steve Schueth (2003) provides more detail on the topic by highlighting the investor motivations and strategies used by socially responsible investors. Schueth (2003) argues that socially responsible investors are motivated to put their money into investments that align with their personal values and they are motivated to put their money into investments that help improve the livelihood of others. Similarly, he posits that investors have three strategies to achieve a desired financial return while abiding to

their own moral compass. First, he argues that screening—including or excluding companies from your portfolio based on some kind of social or environmental criteria—is an effective way for the socially responsible investor to achieve his/her portfolio goals. Second, he suggests that shareholder advocacy—actions that investors take in their role of as owners of corporate America—is a very effective way for the socially responsible investor to achieve his/her portfolio goals. These efforts are aimed at improving the social and environmental responsibilities of corporations. Third, he claims that community investing—providing capital to individuals who cannot routinely access funds—is an effective way of achieving his/her portfolio goals. He states that many socially responsible investors give a small percentage of their investment to Community Development Financial Institutions (CDFIs). These CDFIs then give that money to small business owners who cannot easily access capital through a more traditional route, like receiving a loan from a bank.

Derwall, Guenster, Bauer, and Koedijk (2005) analyzed the performance of socially responsible portfolios. Like Hamilton, Jo, and Statman (1993), these authors wanted to see if socially responsible portfolios outperform conventional portfolios. Unlike other studies in the past that use screens to determine what is socially responsible and what is not, the authors use a new metric—eco efficiency. Derwall, Guenster, Bauer and Koedijk (2005) define eco-efficiency as the "ratio of the value that the company adds to the waste the company generates by creating that value." (Pg. 53) They constructed two portfolios based on eco-efficient rated-data—an eco-efficient portfolio and an eco-*in*efficient portfolio. From the time period of 1995-2003, they found that the eco-efficient

portfolio generated larger positive abnormal returns than the eco-inefficient portfolio. By using regression models to analyze their data, they found that the difference in the two portfolios' performance could not be explained by differences in, "market sensitivity, investment style or industry-specific factors." Effectively, the authors found that an investor who factors ESG traits in their portfolio construction can benefit more than an investor who does not.

Galema, Plantiga, and Scholten (2008) analyze the relationship between socially responsible investing practices and expected returns. They cite Merton's (1987) paper and argue that price differentials would exist if the demand was different for different kinds of stocks—including incomplete information. They claim that the increased demand for socially responsible stocks will cause stocks to be overpriced. Interestingly enough, this paper is one of the few that I found that discusses how Merton's (1987) model would affect these kind of stocks *and* how it would affect sin stocks. They claim that "irresponsible" firm's stocks would not be as popular as socially responsible firm's stocks and that would lead to an underpricing, and ultimately lead to a return premium. In their article, they analyze monthly stock returns from years 1992-2006 and they set up 12 distinct portfolios—reflecting the socially responsible scores they used to organize their data. They find two things. First, they find that the aggregate analysis of SRI scores does not eliminate a relationship if individual dimensions of SRI have opposite effects on performance. Similarly, they find that SRI impacts stock returns by lowering the book-to-market ratio and not by generating abnormal returns.

Dan Weil (2018) published an article in the Wall Street Journal that discusses how socially responsible ETFs in the most recent fiscal year have performed. Using data

from ETF.com, Weil (2018) points out that 26 out of 47 socially responsible ETFs (approximately 55%) outperformed the broad market—using the SPDR S&P 500 ETF—since March 31, 2017. He claims that this outperformance is caused by an updated screening approach used by fund managers. Instead of eliminating stocks with negative ESG traits or because certain kind of stocks were from immoral industries, these fund managers now research stocks with positive ESG scores and construct ETFs with the highest performing stocks. While he notes that this is a significant development for socially responsible investing, he argues that investors should be cautious. Over a ten-year time horizon, he finds that eight of the forty-seven funds have been around since the late 2000s. Furthermore, he claims that out of these eight funds, each of which is screened for ESG traits, none of them outperformed the SPDR ETF over the last decade—which has a 10-year annualized return of 9.4%. In addition, four of the eight socially responsible ETFs have negative 10-year annualized returns. While Weil questions the sustainability of the excess returns generated by socially responsible ETFs, he validates two claims—over the past decade, socially responsible ETFs have gained immense popularity among investors, but, they have underperformed as compared to common benchmarks.

c. Future of Sin Stocks Literature Review

I could not find any academic papers that discussed the possibility, or the indication, of future industries that will perceived as sinful by investors one day. While this may be the case, I hypothesize that one day, the following industries will be perceived as sinful

by both individuals and institutions—fast food/sugary foods, sugary beverages, biotech & pharmaceutical and technology/social media. Even though there have been no academic papers discussing the possibility of these industries being viewed as sinful, there has been a tremendous amount of research done and a plethora of articles published that highlight the immoral/unethical traits of these industries. I believe that these articles published by major news outlets are the stepping-stone for more academic research to be done on the topic.

The fast food industry in the U.S. is incredibly profitable. According to Statista, the fast food industry is projected to generate $214.8B in revenue in 2018.[3] Major players in the industry include McDonald's, Yum! Brands, and Chipotle. Despite the financial success of these food chains, they have received numerous negative headlines over the years. The fast food industry has been claimed to be at the core of both the type-two diabetes epidemic and the obesity epidemic in the U.S. Mello, Rimm and Studdert (2003) analyze one of the most prominent lawsuits against the fast food industry. In 2002, a group of adolescents from New York City sued the McDonald's Corporation and argued that the McDonald's food they consumed caused them negative health side-effects—including obesity, type-two diabetes, etc. These children claimed that McDonald's used misleading advertising, produced grossly unsafe food, and failed to warn its consumers about the adverse side effects that come from its consumption. While McDonald's won the case, this conflict stirred up a tremendous amount of negative press about the fast

[3] "Leading quick service restaurant (QSR) chains in the United States in 2017, by sales per unit (in million U.S. dollars)", Statista, accessed November 23, 2018, https://www.statista.com/statistics/242870/average-sales-per-system-unit-of-quick-service-restaurant-chains/.

food industry and it caused discussion about the adverse health effects associated with eating fast food. Interestingly enough, the article references a current sinful industry extensively—the tobacco industry. The tobacco industry is plagued with similar kinds of lawsuits regarding the role of the industry in promoting unhealthy lifestyle choices. Arguably, the most significant source of information regarding the adverse health effects associated with eating fast food is Morgan Spurlock's documentary, *Super-Size Me.* In his critically acclaimed documentary, Spurlock eats McDonald's three times a day for a month. Throughout the course of the month, his weight dramatically increases, his energy levels fall, and he is affected by a whole host of negative side-effects.[4] His documentary was the breakthrough piece that solidified two things; the adverse health effects of eating fast food and the role of the fast food industry in the U.S.'s type-two diabetes and obesity epidemic. I believe that as investors in U.S. equity markets become more socially responsible, they will eventually perceive the fast food industry, and the sugary food industry, sinful.

The beverage industry is eerily similar to the fast food industry—they both are incredibly profitable, they both rake in billions of dollars in annual revenue, and they both contribute to the type two diabetes and obesity epidemic in the U.S. Major players in the industry, such as the Coca-Cola and PepsiCo, are known to include all kinds of unhealthy ingredients in their products—including sugar and aspartame, both of which have been linked a plethora of adverse health effects. A study by Harvard's School of Public Health, revealed a series of alarming findings related to the impact sugary beverages have on Americans. They found that people who regularly drink sugary

[4] Morgan Spurlock, *Super Size Me* (2004; Samuel Goldwyn Films, 2004), Film.

beverages (1-2 cans or more a day) have a 26% greater risk of developing type two diabetes than those who don't. In another study, more than 40,000 men were followed around for two decades. In their study, they found that those individuals who had just one can of soda per day had a 20% higher risk of having a heart attack or dying from a heart attack than men who didn't drink soda.[5] Eventually, I believe investors in U.S. equity markets will widely perceive the sugary beverage industry sinful. Much like the fast food industry, extensive studies list the adverse health effects that arise from consuming their products.

Unlike the fast food and sugary beverage industries, biotech & pharmaceutical industries do not contribute to the obesity epidemic in the USA. The biotech industry has the potential to be widely perceived as sinful by investors going forward due to the rapid development of groundbreaking sciences. In an article titled *Thinking Ethically About Human Biotechnology*, Margaret R. McLean, Ph.D., (2000) discusses the development of biotechnology and the concern that has developed over the growth of the field. She states that modern biotechnology has one goal—to increase human health and lifespans. She argues that while these developments are fascinating, many people are becoming concerned with the field's development; these people believe that the developments that come out of this industry have led to belief that humans are getting too much power over their evolution and destiny. She states,

> Since the birth of Dolly the cloned sheep, public concern about advancing biotechnology has been enflamed by the suspicion that science is at the mercy of the

[5] "Soft Drinks and Disease," Harvard School of Public Health, accessed November 18th, 2018, https://www.hsph.harvard.edu/nutritionsource/healthy-drinks/soft-drinks-and-disease/.

> technological imperative, the propensity to think that because something can be done, it is inevitable. This seemingly easy slide from can to will—because it is technically possible to clone a child into existence, it will become an everyday occurrence, for example—leaves some with a sense of fatedness, a sense that science is unstoppable. Hence, for those people, science is not a subject of ethical concern.

The development of the biotech industry has done amazing things for the growth of advanced sciences. However, like McLean (2000) points out, many people are concerned that these developments create ethical dilemmas where science essentially plays the role of God. With the continuous developments of the biotech industry, I believe that eventually these developments will scare people enough and this industry will be perceived as sinful.

On the other hand, I believe that the pharmaceuticals industry will not be eventually be perceived as sinful due to their developments; it will be perceived as sinful because of the moral and ethical challenges it creates when it sells goods on the market. In an article published by the Seven Pillars Institute for Global Finance and Ethics, an independent not-for-profit think tank, Rachel Thomas (2017) discusses the moral and ethical problems that are created by this industry. In her article, she explains how businesses, at the end of the day, need be profit maximizers while abiding to the legal landscape. However, she argues that the pharmaceutical industry presents an instance where social good might take precedent over profit maximizing. She notes that the role of pharmaceutical industry is to serve the public good—the nature of the industry is to provide medication to those who need it. She notes that in many cases, the demand for medication is inelastic, incentivizing the pharmaceutical companies to price their goods

incredibly high. This is exemplified with the actions of Martin Shkreli, aka "Pharma Bro," when his company Turing Pharmaceuticals acquired manufacturing license for the drug Daraprim in 2015. Daraprim is a drug that treats a life-threatening parasitic infection; this infection, known as toxoplasmosis, is most deadly for AIDS and cancer patients. Once Shkreli acquired the manufacturing license for Daraprim, he marked up prices from $13.50 per tablet to $750 per tablet—a price increase of 5,455%. Similarly, Thomas (2017) points out that pharmaceutical companies have high operating costs that stem from research and development, fighting legal battles, and the distribution of their goods. The U.S. government incentivizes the creation and development of medication that promotes public good by granting patents and subsidies. Thomas (2017) highlights the moral and ethical dilemmas created by the pharmaceutical industry. Firms are incentivized to research and develop new medication, but the incentives create a monopolistic structure. Consequently, these firms can, and have, marked up prices in such a monstrous way because the demand for these medications is inelastic. For these reasons, I believe that investors will eventually perceive this industry sinful as socially responsible investing practices continue to grow.

Finally, I believe that investors will eventually perceive technology/social media companies sinful. Technology companies are creating a new epidemic around the world—they are contributing to the human addiction to contemporary digital products. In a recent New York Times article, author Claudia Dreifus (2017) interviews social psychologist Adam Alter. In his new book, *Irresistible: The Rise of Addictive Technology and the Business of Keeping Us Hooked,* Alter argues that humans of all ages are literally addicted to digital products, such as their phone. In their interview, Alter first defines

addiction as compulsively doing something you enjoy doing in the short term that undermines your well-being in the long term. He cites a scientific truth—when people are addicted to something, their brain will release a chemical called dopamine. Studies have shown that images of the human brain in front of slot machine—of a proclaimed addicted gambler—show similar results of images of the human brain looking at a video game or on their phone. He points to a few studies to bolster his argument that technology has fueled behavioral addictions—including a study that shows that 60% of adults keep their cell phones next to them when they sleep and another study that shows that half of the respondents check their emails during the night. Companies, such as Apple and Samsung, manufacture these devices which can cause users to become addicted. Furthermore, these devices support the growth of social media companies.

Social media companies, such as Facebook, Instagram, and Snapchat, contribute to the growth of the technology addiction around the world. These social media companies are dangerous because of the plethora of information they have access to. In April 2018, Mark Zuckerberg, CEO of Facebook, testified in front of Congress. Senators from both sides of the aisle wanted to address the elephant in the room—should Facebook be regulated more by the government? Facebook was used by the Russians to interfere in the 2016 Presidential election to promote "fake-news" media. Similarly, data from millions of Facebook users were collected without their explicit permission by a political consulting firm, Cambridge Analytica.[6] When Facebook found out that Cambridge Analytica was harvesting data from their networks, Facebook didn't notify the Federal

[6] Kevin Roose and Cecilia Kang, "Mark Zuckerberg Testifies on Facebook Before Skeptical Lawmakers," *The New York Times*, 2018, https://www.nytimes.com/2018/04/10/us/politics/zuckerberg-facebook-senate-hearing.html.

Trade Commission because they believed it was a "closed case." The most compelling discussion that came out of the Senate hearings was the debate between Senator Lindsey Graham and Mark Zuckerberg over increased regulation of Facebook. Zuckerberg said that there should be limited government regulation of Facebook—he argued that as the internet becomes more important it needs to be regulated in a proper manner.[7] Similarly, social media is dangerous because of the adverse health effects associated with its usage. In an article from the Child Mind Institute, Caroline Miller (2017) discusses a series of studies that point to the link between social media usage and depression levels. According to several recent studies, teenagers and young adults that use Instagram and Facebook are shown to have higher rates of reported depression as compared to people who don't use them. She notes that these studies show a correlation between social media usage and depression levels, not a causation between social media usage and depression levels. Despite this, the correlation between social media usage and reported depression levels is significant. She posits that depression is influenced by artificial connections—where people become friends with each other over a social media platform and not in person. This kind of friendship tends to be less emotionally satisfying, and causes people to feel socially vacuous. Similarly, she notes that social media usage tends to negatively impact one's self-esteem. This is particularly true for females, who see edited photos of beautiful woman all over social media and feel inadequate. The technology industry and the social media industry have created a technology addiction around the world. The technology companies bolster the addiction by creating a platform for these social media

[7] Arjun Kharpal, "Mark Zuckerberg's testimony: Here are the key points you need to know," *CNBC*, 2018, https://www.cnbc.com/2018/04/11/facebook-ceo-mark-zuckerberg-testimony-key-points.html.

companies to grow and flourish. I believe that investors will eventually perceive these two industries sinful due to the industries' ethical dilemmas and the adverse health effects correlated with their usage.

3. Hypothesis Development

The existing literature suggests four hypotheses. First, I hypothesize that socially responsible investing practices do not generate positive abnormal returns. Weil (2018) showed how socially responsible ETFs over the past decade underperformed as compared to the SPDR S&P 500 ETF. However, Weil (2018) did not use any capital asset pricing model analysis on the performance of socially responsible ETFs in his study.

> H1: Across all capital asset pricing models, socially responsible ETFs do not generate statistically significant positive abnormal returns since the funds' inceptions.

Second, I hypothesize that portfolios of sin stocks generate positive abnormal returns. While Hong and Kacperczyk (2009) use SIC codes to create portfolios of alcohol stocks, my portfolios are more robust and inclusive as I am intending to capture the performance of the industry as a whole. My portfolios of current sin stocks include more SIC codes than Hong and Kacperczyk's (2009) portfolios of current sin stocks. I differentiate my study from theirs because I analyze the performance of the sinful industry as a whole—including SIC codes related to manufacturing, distribution, bottling, etc. for all of my

sinful portfolios. My methodology for creating portfolios of current sin stocks, based on robust SIC codes intended to capture the sinful nature of the industry as a whole, is unique and provides a new method of examining the existence of the sin stock anomaly. The competing nature of the literature reviews on the sin stock anomaly need to be addressed further. Over the past couple of years, academic papers such as Fabozzi and Blitz (2017) and Adamsson and Hoepner (2015) claim that the sin stock anomaly is non-existent once Fama-French Factor Models add more explanatory variables, such as momentum, profitability and investment. However, the original papers discussing the performance of sin stocks, such as Fabozzi, Ma and Oliphant (2007) and Hong and Kacperczyk (2009) find overwhelming evidence that portfolios of sin stocks generate positive abnormal returns.

> H2: Portfolios of current sin stocks (alcohol, tobacco, gaming and aerospace & defense), generate positive and statistically significant levels of positive abnormal returns from 1977-2018.

Third, I believe that as socially responsible investing practices continues to grow in U.S. equity markets, the following industries will eventually be perceived as sinful by both investors and institutions: sugary beverages, fast food/sugary foods, biotech & pharmaceuticals and tech/social media. As far as I am aware, I am the first person to argue that these industries will eventually be widely perceived as sinful and I am the first person to argue that portfolios of stocks from these industries may exhibit an increased level of positive abnormal returns if they are eventually perceived as sinful by both

institutions and individuals. I believe that the morally and ethically hazardous nature of these industries in the past, and present, has positively impacted the performance of portfolios of these industries—implying that portfolios of these future sin stocks have generated positive abnormal returns.

> H3: Across all capital asset pricing models, portfolios of future sin stocks generate positive and statistically significant levels of abnormal returns from 1977-2018.

Fourth, I believe that events that increase the perceived sinfulness of these industries result in greater levels of abnormal returns for sinful portfolios as compared to before they were deemed sinful. By choosing a critical point in time in which the perception of these industries' morally and ethically hazardous nature spikes, we can compare the performance of the same portfolio before and after that critical point in time. As far as I am aware of, I am the first person to do event studies on the performance of these portfolios before and after these industries were widely perceived as sinful.

> H4: Portfolios of alcohol and tobacco stocks will generate larger positive levels of abnormal returns after their industries are widely perceived as sinful, as compared to before their industries are widely perceived as sinful, across capital asset pricing models.

4. Data and Methodology

a. Socially Responsible Investing Data

In order to analyze the performance of socially responsible investments, I chose to look at socially responsible exchange traded funds (ETFs) that were screened for basic ESG traits. Instead of creating portfolios of what I believe to be socially responsible stocks, I purposefully chose to look at ESG screened ETFs instead. The ETFs that I chose to analyze the performance of are representative of key ESG screens including workplace equality and low carbon exposure. First, the construction of these ETFs already creates portfolios of socially responsible stocks. Major investment advisors, such as Vanguard and BlackRock, create these ETFs in order to appeal to socially responsible investors. I believe that their incentives to create socially responsible ETFs warrants their usage for my analysis. Second, I chose to look at ETFs instead of creating my own portfolio of socially responsible stocks because of the ease in investing in ETFs. Investing in an ETF tends to be cheaper than creating a portfolio of stocks for the individual investor. Because of the work done and accessibility of ETFs, I believe they provide the best proxy for socially responsible investing performance. While I do believe that somebody could create a portfolio of socially responsible stocks and generate positive abnormal returns, I do not have any data on the topic nor do I think that the individual/institution who did would make it readily accessible.

I chose to look at the performance of five socially responsible ETFs. While all of these ETFs are socially responsible, they all are different in some way. These funds

originate from different investment advisors and they all focus on different aspects of ESG traits. In this section, I list the ETF provider, some basic financial information, some of the top ten holdings of the fund, the reasoning behind the fund being socially responsible, and the ticker name denoted in parentheses. Similarly, I have collected the monthly returns of all of these ETFs. The monthly returns of some of these ETFs date back to 2006. On the other hand, I only have monthly returns from these some of these ETFs as recent as 2014. I believe that these monthly returns create a robust enough sample size to analyze the performance of these socially responsible investment vehicles. **Figure 2** exhibits the total returns of my socially responsible ETFs since their inception. Similarly, **Figure 2** shows the total return for the S&P 500 TR index and the Vice Fund—an ETF composed of sinful industries—since their inceptions.

The first ETF that I chose to analyze is the iShares MSCI KLD 400 Social ETF (DSI). iShares is an ETF provider affiliated with BlackRock. iShares states that the objective of DSI is to, "track the investment results of an index composed of U.S. companies that have positive environmental, social and governance characteristics as identified by the index provider."[8] As of November 5th, 2018, DSI has over $1.1B in net assets and approximately twelve million shares outstanding. The top 10 holdings of the ETF include Microsoft, Alphabet, Facebook, Proctor and Gamble, Coca-Cola and Merck &Co. Inc. iShares highlights the sustainability characteristics of the fund. DSI has an ESG quality score of 6.6 out of ten according to MSCI, a global provider of investment decision support. Similarly, DSI has an ESG quality score (which is peer ranked) of

[8] "iShares MSCI KLD 400 Social ETF," iShares by BlackRock, accessed November 18th, 2018, https://www.ishares.com/us/products/239667/ishares-msci-kld-400-social-etf.

98.70 percent—implying that fund is in the 98th percentile of ESG quality scores based on MSCI's data.[9] I collected monthly returns of DSI from July 2010 to October 2018.

The second socially responsible ETF I chose to analyze is iShares MSCI USA ESG Select ETF (SUSA). iShares states that the objective of SUSA is the same as DSI. However, the two funds are different. Using MSCI data, SUSA has a higher ESG quality score than DSI—8.2. Consequently, SUSA is in the 100th percentile ESG quality score rank, implying that it one of the most, if not the most, socially responsible ETF based on MSCI's data. SUSA does have a smaller amount of net assets as compared to DSI ($762M) and far fewer shares outstanding as compared to DSI (nearly seven million). Some of the funds top ten holdings include Microsoft, Apple, 3M, Rockwell Collins and BlackRock Inc.[10] I collected the monthly returns of SUSA from January 2005 to October 2018.

The third socially responsible ETF I chose to analyze is First Trust NASDAQ Cln Edge GrnEngyETF (QCLN). First Trust is an investment advisor that offers investment products like BlackRock or VanEck. First Trust states that the goal of the fund is, "to seek investment results that correspond generally to the price and yield (before the Fund's fees and expenses) of an equity index called the NASDAQ Clean Edge® Green Energy IndexSM.[11] Essentially, this ETF tracks an index that focuses on clean energy companies. Included in the index are "companies engaged in manufacturing, development, distribution and installation of emerging clean-energy technologies including, but not

[9] iShares by BlackRock, "iShares MSCI KLD 400 Social ETF."
[10] "iShares MSCI USA Select ETF," iShares by BlackRock, accessed November 18, 2018, https://www.ishares.com/us/products/239692/ishares-msci-usa-esg-select-etf
[11] "First Trust NASDAQ Clean Edge Green Energy Index Fund (QCLN)," First Trust, accessed November 18th, 2018, https://www.ftportfolios.com/Retail/Etf/EtfSummary.aspx?Ticker=QCLN

limited to, solar photovoltaics, biofuels and advanced batteries."[12] As of 11/5/2018, QCLN has total net assets of $89M and 4.6M shares outstanding. Some of the ETFs top ten holdings include Tesla Inc., Albemarle Corporation, Acuity Brands, Inc., and Hexcel Corporation. I collected monthly returns from February 2007 to October 2018.

The fourth socially responsible ETF I chose to analyze is iShares MSCI ACWI Low Carbon Target ETF (CRBN). Like DSI and SUSA, CRBN is offered by iShares. According to iShares, the objective of the fund is to, "track the investment results of an index composed of large and mid-capitalization developed and emerging market equities with a lower carbon exposure than that of the broad market."[13] CRBN appeals to socially responsible investors who want both exposure to a global portfolio and to invest in companies with a low carbon footprint. According to MSCI data, CRBN has an ESG quality score of 5.8—it lags behind DSI's and SUSA's ESG quality score. CRBN has $522M worth of net assets and it has 4.6M shares outstanding. Some of the funds top ten holdings include Apple Inc., Amazon Com Inc., Johnson & Johnson, Facebook and JPMorgan Chase & Co. I collected monthly returns from December 2014 to October 2018.

The fifth socially responsible ETF I chose to analyze is the Workplace Equality ETF (EQLT). This fund is offered by Segall Bryant and Hamill, an independent investment firm. According to the firm, "The Workplace Equality Portfolio ETF invests in publicly-traded companies that support lesbian, gay, bisexual and transgender (LGBT) equality in

[12] First Trust, "First Trust NASDAQ Clean Edge Green Energy Index Fund (QCLN)."
[13] "iShares MSCI Low Carbon Target ETF," iShares by BlackRock, accessed November 20, 2018, https://www.ishares.com/us/products/271054/ishares-msci-acwi-low-carbon-target-etf.

the workplace."[14] One of the most significant screens for this ETF is that the company must include "mandatory language in a company's equal employment opportunity (EEO) statement prohibiting discrimination based on sexual orientation and gender identity, offering health benefits to same-sex partners or spouses of employees, along with other corporate benefits and privileges." EQLT has $21M worth of net assets. Some of the funds top holdings include Global Eagle Entertainment, Nvidia Corp., Walt Disney Co., Under Armour and American Eagle Outfitters. I collected monthly returns from February 2014 to October 2018.

b. Sin Stock Data

i. Portfolio Construction for Current Sin Stocks

In order to analyze the performance of sin stocks and to see if the sin stock anomaly exists, I created portfolios of the current sinful industries—alcohol, tobacco, gaming, and aerospace & defense. In previous examinations of the sin stock anomaly, researchers created sinful portfolios in a few different ways. Some researches created sinful portfolios based on existing benchmarks. For example, Hong and Kacperczyk (2009) created sinful portfolios based on NAICS (North American Industry Classification System) groupings and limited SIC code groupings. Blitz and Fabozzi (2017) created sinful portfolios based on Fama-French industry groups. In all of my academic research

[14] "The Workplace Equality Portfolio ETF—EQLT," EQLT: Workplace Equality Portfolio, accessed November 20, 2018, http://www.eqltfund.com.

on the topic, I didn't see anyone create as robust sinful portfolios based on SIC codes. Hong and Kacperczyk (2009) used SIC codes to create their sinful portfolios but I used more SIC codes than they did in an attempt to see the performance of the industry as a whole. Using SIC codes to create my sinful portfolios, I then gathered a comprehensive dataset from the Wharton Research Data Services (WRDS) platform. I collected monthly stock returns from June 1977 until June 2018. These stock returns were paired with their respective SIC code—denoting SIC grouping with the return. In total, my dataset had over 3.5 million observations. I then filtered the dataset based on SIC codes to create my current sinful portfolios. These portfolios of current sin stocks are equal-weighted—I felt that this type of portfolio construction would be the best because it evenly distributes the magnitude of the performance for each security.

The first sinful portfolio that I created was alcohol. I filtered my dataset with the following SIC codes to create my alcohol portfolio: 5181 (Beer and Ale,) 5182 (Wine and Distilled Alcoholic Beverages), 2083 (Malt), 2084 (Wines, Brandy, and Brandy Spirits), 2085(Distilled and Blended Liquors), and 5813 (Drinking Places [Alcoholic Beverages]). Companies included in this portfolio include Diageo LLC and Constellation Brands—two of the largest alcohol companies in the world. Once I created my alcohol portfolio, I had monthly stock returns from June 1977 to June 2018.

The second sinful portfolio that I created was tobacco. I filtered my dataset with the following SIC codes to create my tobacco portfolio: 2111 (Cigarettes), 2121 (Cigars), 2131 (Chewing and Smoking Tobacco and Snuff), 2141 (Tobacco Stemming and Redrying), 5194(Tobacco and Tobacco Products), 5993 (Tobacco Stores and Stands), and 0132 (Tobacco). Companies included in this portfolio include Phillip Morris and R J

Reynolds. Once I created my tobacco portfolio, I had monthly stock returns from June 1977 to June 2018.

The third sinful portfolio that I created was gaming. I filtered my dataset with the following SIC codes to create my gaming portfolio: 7993(Coin-operated Amusement Devices), 8741 (Management Services), 7011 (Hotels and Motels), and 7948 (Racing, including Track Operation). Some of the companies included in this portfolio include Las Vegas Sands and MGM Resorts. Once I created my gaming portfolio, I had monthly stock returns from June 1977 to June 2018.

The fourth sinful portfolio that I created was aerospace & defense. I filtered my dataset with the following SIC codes to create my aerospace & defense portfolio: 3721 (Aircraft), 3764 (Guided Missile and Space Vehicle Propulsion Units and Propulsion Unit Parts), 348 (Ordnance and Accessories, except Vehicles and Guided Missiles), 3812 (Search, Detection, Navigation, Guidance, Aeronautical and Nautical Systems), 3679 (Electric Components, not elsewhere classified) and 7371 (Computer Programming Services). Some of the companies in this portfolio include Raytheon, Northrop Grumman and Remington Arms Co. This portfolio was created to capture significant aspects of both the aerospace industry and the defense industry. Once I created my portfolio, I had monthly stock returns from June 1977 until June 2018.

ii. Portfolio Construction for Future Sin Stocks

The first "future sin stock" portfolio I created was sugary beverages. I filtered my dataset with the following SIC codes to create my sugary beverage portfolio: 2086

(Bottled and Canned Soft Drinks and Carbonated Waters), 2087 (Flavoring Extracts and Flavoring Syrups, Not Elsewhere Classified), and 3121(Beverage Manufacturing), and 5812 (Eating Places). Some of the companies in this portfolio include the Coca-Cola Co. and the Starbucks Corporation. This portfolio does a good job getting all elements of this sinful industry involved—from the actual manufactures of the product to the producers of the artificial sweeteners. Once I created this portfolio, I was able to get monthly stock returns from June 1977 to June 2018. All of my portfolios of future sin stocks are equal-weighted—I felt that this type of portfolio construction would be the best because it evenly distributes the magnitude of the performance for each security.

The second "future sin stock" portfolio I created was fast food/sugary food companies. I filtered my dataset with the following SIC codes to create my sugary food portfolio: 2041 (Flour and other Grain Mill Products), 2043 (Cereal Breakfast Foods), 2045 (Prepared Flour Mixes and Doughs), 2051 (Bread and other Bakery Products), 2052 (Cookies and Crackers), 2065 (Candy and other Confectionary Products), 2066 (Chocolate and Cocoa Products), 2096 (Potato Chips, Corn Chips and Similar Snacks), 5441 (Candy, Nut, and Confectionary Stores), and 5812 (Eating Places). Some of the companies in this portfolio include McDonald's and Hershey. I believe the large amount of SIC codes used to filter this portfolio show how broad and expansive this industry is and how so many companies are all connected by usage of sugar and the adverse health effects associated with eating their products. Once I created this portfolio, I was able to get monthly stock returns from June 1977 to June 2018

The third "future sin stock" portfolio I created was biotech and pharmaceuticals. I filtered my data with the following SIC codes to create my biotech and pharmaceuticals

portfolio: 2834 (Pharmaceutical Preparations) and 8731 (Commercial Physical and Biological Research). While this portfolio is filtered using only two SIC codes, I feel that these two SIC codes are the most representative of each industry—biotech and pharmaceuticals. Some of the companies included in this portfolio include Pfizer, Novartis and Gilead Sciences. Once I created this portfolio, I had monthly stock returns from June 1977 to June 2018.

The fourth "future sin stock" portfolio I created was tech/social media. I filtered my data with the following SIC codes to create my tech/social media portfolio: 7371 (Computer Programming Services), 7374 (Computer Processing and Dara Preparation and Processing Services), and 5734 (Computer and Computer Software Stores). Some of the companies included in this portfolio include Facebook, Google and Apple. These three SIC codes capture the companies involved in the tech industry and the social media industry. Once I created this portfolio, I had monthly stock returns from June 1977 to June 2018.

5. Methodology for Linear Regression Models

a. Regression Models

To see the performance of portfolios of current sin stocks, "future" sin stocks and socially responsible ETFs, I used three different capital asset pricing models (CAPM). The traditional CAPM model states:

$$ER_i = rf + Bi(ERm - rf)$$

Where ER_i is equal to the expected return on investment, rf is equal to the risk-free rate, Bi is equal to the Beta of the investment (measurement of volatility in comparison to the entire market,) ERm is the expected return of the market and $(ERm - rf)$ is the market risk premium. Essentially, the traditional CAPM describes an asset's relationship between its systematic risk and its expected return.

The first CAPM model I used was the Fama-French Three Factor Model. Fama and French (1993) identify and create three distinct factors that help explain variation in stock returns—a market factor, a firm size factor, and a book-to-market factor. The results from their empirical studies solidified the explanatory power of their variables in identifying variation in stock returns. In their model, they take traditional CAPM and expand on it. The Fama French 3 Factor Model states:

$$R_{it} - rf_t = \alpha_t + Bi(Rm_t - rf_t) + SMB_t + HML_t + \varepsilon_{it}$$

Where $R_{it} - rf_t$is the expected excess return, α_t is the alpha—or excess return—generated at time 't', $Bi(Rm_t - rf_t)$ is market variable SMB_t is the average return on three small portfolios minus the average return on the three big portfolios, HML_t is the average return on two portfolios—with high book-to-market ratios minus low book-to-market ratios, and ε_{it} is the error term for each portfolio "i" at time "t". Fama and French (1993) found that the three factors—market, HML and SMB—capture a statistically significant fraction of the variation in stock returns.

The second CAPM model I used is the Fama-French 3 Factor Model plus Momentum. Carhart (1997) solidifies the explanatory power of the three Fama-French factors and introduces a new variable—momentum. This momentum factor describes a tendency in stock prices—if stock prices are rising, they tend to continue to rise and if

stock prices are falling, they tend to continue to fall. The Fama-French 3 Factor Model plus Momentum states:

$$R_{it} - rf_t = \alpha_t + Bi(Rm_t - rf_t) + SMB_t + HML_t + UMD_t + \varepsilon_{it}$$

In an article from Seeking Alpha, Bortolotti (2016) explains that the momentum factor is calculated by taking the average return on the two high prior returns portfolios minus the average return on the two low prior returns portfolios. Similarly, he states that the time table for the momentum factor is anywhere from 2 to 12 months as stocks have the tendency to revert to the mean over periods of several years. Essentially, the Fama-French 3 Factor Model including the momentum factor is a more complete CAPM than the Fama-French 3 Factor Model. More importantly, it is useful to see how this model affects the level alpha generated by the socially responsible ETFs, the current sin stocks, and the future sin stocks.

The third CAPM model I used is the Fama-French 5 Factor Model, introduced by Titman, Wei and Xie (2004). In this CAPM, they expand the Fama-French 3 Factor Model by adding two new variables that help analyze variation in stock returns—the profitability and the investment factor. The profitability factor aims at exploring the variation in stock returns by focusing on the ratio of gross profits to total assets. Economists believe that the profitability factor helps explain variation in stock prices by creating a positive relationship between profitability and stock returns.[15] On the other hand, the investment factor aims to explain variation in stock prices by looking at a firm's capital expenditures. Titman, Wei and Xie (2004) find a negative relationship between

[15] Vikas Kalra and Christian Celis, "Research Insight: Introducing the Profitability Factor," *MSCI,* (2016): 2.

capital expenditures and stock returns—firms that increased their capital expenditures the most were the firms that underperformed the most, based on their benchmarks. On a similar note, they found a significant piece of evidence regarding the term they call "greater investment discretion." They point to their analysis and say that firms that have greater investment discretion (firms with less debt or more cash flows) have a stronger negative relationship between capital expenditures and stock returns as compared to firms that have less investment discretion. The Fama-French 5 Factor Model states:

$$R_{it} - rf_t = \alpha_t + Bi(Rm_t - rf_t) + SMB_t + HML_t + RMW_t + CMA_t + \varepsilon_{it}$$

Where $R_{it} - rf_t$is the expected excess return, α_t is the alpha—or excess return—generated at time 't', $Bi(Rm_t - rf_t)$ is market variable SMB_t is the average return on three small portfolios minus the average return on the three big portfolios, HML_t is the average return on two portfolios—with high book-to-market ratios minus low book-to-market ratios, and ε_{it} is the error term for each portfolio "i" at time "t". The two new factors, profitability and investment, look at the difference of stock returns of two distinct portfolios. RMW_t examines the difference of stock returns from a portfolio with robust profitability as compared to the stock returns from a portfolio with weak profitability. CMA_t examines the difference of stock returns from a portfolio with low investment firms as compared to the stock returns from a portfolio with high investment firms. The Fama-French 5 Factor Model is the most complete CAPM in my study. The five significant variables it employs is the most significant asset pricing model in my study to explain the variation in stock prices and to help explore my results.

These three distinct factor models are used to examine the performance of socially responsible ETFs, portfolios of current sin stocks and portfolios of future sin stocks.

Across all data analysis, I use a simple linear regression model to see the explanatory power of each variable, the significance of each factor on the variation in the data, and the statistical significance of each factor on the variation in returns. I set up my linear regression as follows. My dependent variable (left-side of the equation) is my "return" variable. This variable is the return of the stock/ETF at time "t" minus the risk-free rate at time "t." Essentially, this variable is the premium—or excess return—from investing in this security rather than in a risk-free asset. My independent variables (right-side of the equation) consist of the "market" variable (excess return on the market minus the risk-free rate), "size" variable, "value" variable, "momentum" variable, "profitability" variable and the "investment" variable and the intercept—alpha—which shows the potential excess returns generated in the model.

All of these linear regressions have monthly stock returns dating back from June 1977 to October 2018. These monthly stock returns will be used to explore the performance and levels of alpha (if any) generated from my portfolios of current and future sin stocks. When I examine the performance of socially responsible ETFs, I use their monthly returns instead. I have Fama-French factors of market, size, value and momentum from 1977-2018. However, the profitability and investment factors do not cover that same time horizon since they were recently formulated by Fama and French for public use. The time horizon of these variables span from July 1990 until October 2018. This shrinkage in months (number of observations) decreases my R-squared values as compared the R-squared values generated in the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum.

6. Results

a. The Performance of Socially Responsible ETFs

When I regressed the monthly returns of socially responsible ETFs on the Fama-French 3 Factor Model, I got a few interesting results. Since their inception, EQLT and DSI generated almost no alpha. All of their monthly alpha coefficients were less than 0.001—implying that there was virtually no alpha generated based on this model. Similarly, the ETFs had very low t-statistics and high P > |t|, implying that the alpha coefficient isn't statistically significant and doesn't have a large impact on my return variable (dependent variable.) On the other hand, SUSA and QCLN generated negative monthly alphas of -0.001 and -0.008, respectively. These results support the findings of Weil (2018). By showcasing the negative monthly alphas generated, my model confirms that these ETFs generated negative annualized total returns. Furthermore, SUSA and QCLN generated t-stats of -1.68 and -1.94, respectively, and P > |t| of 0.096 and 0.054, respectively. These two findings help validate the negative monthly alpha generated by the ETFs, proving that these socially responsible ETFs generated negative returns since their inceptions. Interestingly, CRBN generated a monthly alpha of 0.008 which was the highest of all socially responsible ETFs. It had a t-stat of 1.40 and P > |t| value of 0.168. These results showcase the fact that CRBN has generated a positive monthly alpha since inception, but it is not statistically significant as we cannot reject the null hypothesis that alpha coefficient is zero.

The Fama-French 3 Factor Model plus Momentum generated similar results. EQLT, CRBN and DSI generated the same levels of alpha that were generated in the 3 Factor Model. These monthly alphas were so small, implying that these ETFs generated virtually no excess return. All of their t values increased and their P > |t| values got smaller. These findings prove to be insignificant as these monthly alphas do not have a significant effect on my "return" variable. The 3 Factor Model plus Momentum produced similar results for SUSA and QCLN—the two ETFs generated negative monthly alpha values. More importantly, SUSA and QCLN had t-stats of -1.61 and -1.92, respectively, and P > |t| values of 0.110 and 0.058. These statistics help validate the fact that these two socially responsible ETFs generated negative returns since their inception. CRBN produced similar results in this model as it did in the Fama-French 3 Factor Model. It had a monthly alpha of .009, a t-stat of 1.52 and a P > |t| value of 0.138. Like the results from the Fama-French 3 Factor Model, they showcase the fact that CRBN has generated a positive monthly alpha since inception, but it is not statistically significant as we cannot reject the null hypothesis that alpha coefficient is zero.

The Fama-French 5 Factor Model produced the same kind of results for EQLT, CRBN and DSI as the other two linear regression models. They produced incredibly small levels of monthly alpha and their t-stats and P > |t| values were insignificant and useless in our understanding of the model, as they aren't useful in understanding the monthly alphas impact on my return variable. Like the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum, the Fama-French 5 Factor Model once again produced negative monthly alphas for SUSA and QCLN (-0.001 and -0.006, respectively.) SUSA and QCLN produced large t-stats (-2.02 and -1.56, respectively,)

and small P > |t| values (0.045 and 0.120, respectively.) These findings are crucial because they help confirm the fact these two socially responsible ETFs generated negative returns since inception. CRBN once again produced the highest monthly alpha value in the Fama-French 5 Factor Model (.008.) It had a t-stat of 1.44 and P > |t| value of 0.158.

While I was running my linear regression models on the returns of these socially responsible ETFs, I thought it would be interesting to compare the performance of a socially responsible ETF to a sinful ETF. I collected monthly returns from the Vice Fund (MUTF: VICEX), an ETF whose portfolio consists of alcohol, tobacco, gaming, and aerospace and defense stocks. Since its inception in 2002, the Vice Fund has outperformed the S&P 500 and its performance is widely cited as a prime example to bolster the claims of the sin stock anomaly. When I used my three linear regression models on the Vice Fund, I got a few interesting results. First, VICEX generated positive monthly abnormal returns since its inception. Second, VICEX generated t-stats of 0.97, 0.93 and 0.69 in the Fama-French 3 Factor Model, the Fama-French 3 Factor Model plus Momentum, and the Fama-French 5 Factor Model, respectively. These t-stat values help confirm the fact the VICE fund generates some kind of monthly alpha (dissimilar to zero) and it bolsters the evidence of its positive performance over time. However, across all linear regression models, VICEX generates high levels of P > |t|, making it hard to interpret the results. Third, across all linear models, VICEX has the smallest R-squared values when they are compared to the R-squared values across the socially responsible ETFs (except for CRBN). However, VICEX has existed the longest, implying that it has the largest amount of observations. I believe that there are some things that are not being

captured in my CAPM models that would help prove its exceptional performance since inception.

When looking at all of the results from this analysis, it is fair to say a few things. First, all of my CAPM models validate the atrocious performance of the SUSA and QCLN. These two ETFs have generated negative returns since inception, failing to beat the market. Second, DSI and CRBN do not produce any significant results—their monthly alphas are virtually non-existent and their t-stats and P > |t| values prove to be inconclusive. Finally, all of my linear regression models lead me to believe that CRBN, since inception, has generated positive monthly alphas. This performance can be traced back to a point that Weil (2018) makes in his article, noting that socially responsible ETFs have outperformed the market in the most recent fiscal year. CRBN has the smallest amount of monthly observations (43) of all of my socially responsible ETFs in my study, which I believe helps explain the positive performance of this particular ETF. My analysis of the performance of socially responsible ETFs leads me to believe that there is a negative relationship between number of monthly observations and levels of monthly alpha generated. Based on my analysis, I cannot find any other socially responsible ETF besides CRBN that generated a positive monthly alpha and has significant t-stats and P > |t| values that bolster the fact that the monthly alpha coefficient has a significant impact on my return variable. However, based on my analysis, I can point to the performance of SUSA and QCLN in all three of the linear models I use to prove that these socially responsible ETFs generated negative monthly levels of alpha and their t-stats and P >|t| values point to the fact that their negative monthly alpha coefficients have a significant impact on my return variable.

b. The Performance of Current Sin Stocks—Does the Sin Stock Anomaly Exist?

Using the Fama-French 3 Factor Model, I analyzed portfolios of current sin stocks to see if these portfolios generated monthly alphas. After running my linear regression model, portfolios of alcohol, tobacco, gaming and aerospace & defense stocks generated positive monthly alphas (0.006, 0.01, 0.004 and 0.006, respectively.) More importantly, these portfolios of current sin stocks generated huge t-stats and miniscule P > |t| values on the monthly alpha coefficient. Alcohol generated a t-stat of 4.01 and a P > |t| of 0.000. Tobacco generated a t-stat of 4.97 and a P > |t| value of 0.000. Gaming generated a t-stat of 2.85 and a P > |t| value of 0.004. Aerospace & defense generated a t-stat of 4.27 and a P > |t| value of 0.000. Based on the results of my Fama-French 3 Factor Model, it is clear to see that portfolios of all current sin stocks generated positive monthly alphas and their t-stats and P > |t| values solidify the positive significant impact of monthly alpha variable on my return variable.

I then analyzed portfolios of current sin stocks using the Fama-French 3 Factor Model plus Momentum to see if these portfolios generated monthly alphas. After running my linear regression model, portfolios of alcohol, tobacco, gaming and aerospace & defense stocks generated positive monthly alphas (0.007, 0.011, 0.006 and 0.008, respectively.) These results led to a shocking conclusion—the monthly alpha generated in each portfolio was larger for each sinful industry based on the Fama-French 3 Factor Model plus Momentum than the monthly alpha generated in each sinful portfolio based

on the Fama-French 3 Factor Model. Furthermore these portfolios of current sin stocks generated huge t-stats and miniscule P > |t| values on the monthly alpha coefficient. Alcohol generated a t-stat of 3.85 and a P > |t| of 0.000. Tobacco generated a t-stat of 4.95 and a P > |t| value of 0.000. Gaming generated a t-stat of 3.60 and a P > |t| value of 0.000. Aerospace & Defense generated a t-stat of 5.01 and a P > |t| value of 0.000. Based on the results of my Fama-French 3 Factor Model plus Momentum, it is clear to see that portfolios of all current sin stocks generated positive monthly alphas and their t-stats and P > |t| values solidify the positive significant impact of monthly alpha variable on my return variable.

Finally, I analyzed the performance of portfolios of current sin stocks by using the Fama-French 5 Factor Model to see if these portfolios generated monthly alphas. After running my linear regression models, portfolios of alcohol, tobacco, gaming and aerospace & defense stocks generated positive monthly alphas (0.005, 0.006, 0.001 and 0.009, respectively.) Furthermore these portfolios of current sin stocks generated huge t-stats and small P > |t| values on the monthly alpha coefficient. Alcohol generated a t-stat of 2.63 and a P > |t| of 0.009. Tobacco generated a t-stat of 2.12 and a P > |t| value of 0.035. Gaming generated a t-stat of 0.54 and a P > |t| value of 0.589. Aerospace & defense generated a t-stat of 3.96 and a P > |t| value of 0.000. Based on the results of my Fama-French 5 Factor Model, it is clear to see that portfolios of all current sin stocks generated positive monthly alphas and their t-stats and P > |t| values (except for the portfolio of gaming) solidify the positive significant impact of monthly alpha variable on my return variable.

Based on my data analysis using three distinct linear regression models, I have proved the existence of the sin stock anomaly. Across all CAPM models, portfolios of sin stocks generated positive monthly alphas. Furthermore, the alpha coefficient generated by each sinful portfolio across all CAPM models exhibited huge t-stats and low P > |t| values (except for gaming when using the five-factor model.)

c. The Performance of Future Sin Stocks

Using the Fama-French 3 Factor Model, I analyzed portfolios of future sin stocks to see if these portfolios generated monthly alphas. After running my linear regression model, portfolios of sugary beverages, fast food/sugary foods, biotech & pharmaceuticals and tech/social media generated positive monthly alphas (0.003, 0.003, 0.008 and 0.006, respectively.) More importantly, these portfolios of current sin stocks generated huge t-stats and miniscule P > |t| values on the monthly alpha coefficient. Sugary beverages generated a t-stat of 2.01 and a P > |t| of 0.045. Fast food/sugary food generated a t-stat of 2.22 and a P > |t| value of 0.027. Biotech & pharmaceuticals generated a t-stat of 4.68 and a P > |t| value of 0.000. Tech/social media generated a t-stat of 3.32 and a P > |t| value of 0.001. Based on the results of my Fama-French 3 Factor Model, it is clear to see that portfolios of all future sin stocks generated positive monthly alphas and their t-stats and P > |t| values solidify the positive significant impact of monthly alpha variable on my return variable. These findings imply that we can reject the null hypothesis that the alpha coefficient is equal to zero using a 95% confidence interval.

I then analyzed portfolios of current sin stocks using the Fama-French 3 Factor Model plus Momentum to see if these portfolios generated monthly alphas. After running my linear regression model, portfolios sugary beverages, fast food/sugary foods, biotech & pharmaceuticals and tech/social media of generated positive monthly alphas (0.004, 0.004, 0.009 and 0.009, respectively.) These results led to a shocking conclusion—the monthly alpha generated in each portfolio was larger for each sinful industry based on the Fama-French 3 Factor Model plus Momentum than the monthly alpha generated in each sinful portfolio based on the Fama-French 3 Factor Model. Furthermore, these portfolios of current sin stocks generated huge t-stats and miniscule $P > |t|$ values on the monthly alpha coefficient. Sugary beverages generated a t-stat of 2.50 and a $P > |t|$ of 0.013. Fast food/sugary food generated a t-stat of 2.63 and a $P > |t|$ value of 0.009. Biotech & pharmaceuticals generated a t-stat of 5.03 and a $P > |t|$ value of 0.000. Tech/social media generated a t-stat of 4.46 and a $P > |t|$ value of 0.000. Based on the results of my Fama-French 3 Factor Model plus Momentum, it is clear to see that portfolios of all current sin stocks generated positive monthly alphas and their t-stats and $P > |t|$ values solidify the positive significant impact of monthly alpha variable on my return variable. Like the results from the Fama-French 3 Factor Model, these findings imply that we can reject the null hypothesis that the alpha coefficient is equal to zero using a 95% confidence interval.

Finally, I analyzed the performance of portfolios of future sin stocks by using the Fama-French 5 Factor Model to see if these portfolios generated monthly alphas. After running my linear regression models, portfolios of sugary beverages, fast food/sugary foods, biotech & pharmaceuticals and tech/social media generated positive monthly alphas (0.0008, 0.0005, 0.007 and 0.007, respectively.) However, the results from the

Fama-French Five Factor Model show us that portfolios of sugary beverages and fast food/sugary foods do not generate statistically significant alphas. Sugary beverages had a t-stat of 0.43 and a P > |t| value of 0.670. Similarly, fast food/sugary food had a t-stat of 0.33 and a P > |t| value of 0.744. The results from the Fama-French Five Factor model exhibit a statically significant positive alpha coefficient for portfolios of biotech & pharmaceuticals and tech/social media. Biotech & pharmaceuticals had a t-stat of 2.87 and a P > |t| value of 0.004. Tech/social media had a t-stat of 2.60 and a P > |t| value of 0.01. From these results, we can't reject the null hypothesis that the alpha coefficient is zero for portfolios of sugary beverages and fast food/sugary food. On the other hand, we *can* reject the null hypothesis that the alpha coefficient is zero for portfolios of biotech & pharmaceuticals and tech/social media with a 95% confidence interval.

Based on my data analysis using three distinct linear regression models, I have come to a series of conclusions about what I believe will ultimately be future sinful industries. Using the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum, all of my portfolios of future sin stocks generated a positive monthly alpha. These findings were backed by high t-stats and low P > |t| values, implying that we can reject the null hypothesis that the alpha coefficient is zero with a 95% confidence interval. Second, the Fama-French 5 Factor Model showcased that portfolios of sugary beverages and fast food/sugary food didn't generate a statistically significant alpha coefficient. While their monthly alpha coefficients were positive, their t-stats and P > |t| values prove that we cannot reject the null hypothesis is zero with a 95% confidence interval. On the other hand, portfolios of biotech & pharmaceuticals and tech/social media generated a statistically significant positive monthly alpha. Their high t-stats and

low P > |t| values imply that we can reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval. Third, the performance of portfolios of future sin stocks is eerily comparable to the performance of current sin stocks across all factor models I use in my study. Portfolios of current sin stocks have generated similar levels of alpha as compared to portfolios of future sin stocks. Both current and future portfolios of sin stocks across all factor models had very high t-stats and very low P > |t| values, implying that we can reject the null hypothesis that the monthly alpha coefficient is zero—resulting in some form of over performance compared to the market.

7. Event Studies—Performance of Current Sinful Industries Before and After Becoming Sinful

    a. Introduction

Based on my data analysis of portfolios of current and future sin stocks, I have reached three conclusions. First, portfolios of current sin stocks generated a statistically significant positive monthly alpha across three distinct capital asset pricing models. Second, I have proved that all my portfolios of future sin stocks generated a statistically significant positive monthly alpha using the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum. Third, portfolios of biotech & pharmaceutical companies and portfolios of tech/social media companies generated a statistically significant positive monthly alpha across all factor models.

A central argument for my thesis is that as socially responsible investing practices in U.S. equity markets continues to grow, individuals and institutions will eventually deem the following industries sinful: sugary beverages, fast food/sugary food, biotech & pharmaceuticals and tech/social media. I believe that if the sin stock anomaly exists, portfolios of these "future" sin stocks will generate larger levels of positive abnormal returns after they become sinful as compared to before they were perceived as sinful. If all of this were to be true, an investment strategy taking a long position in these future sinful industries would be advantageous in the immediate and long term time horizon.

After running my data analysis, I believe that my models prove that the sin stock anomaly exists. My results prove that the four current sinful industries—alcohol, tobacco, gaming and aerospace & defense—have produced a statistically significant monthly alpha across all factor models, except for gaming when using the Fama-French 5 Factor Model. The results are overwhelmingly supportive of the existence of the sin stock anomaly. Since my results point to the existence of the sin stock anomaly, I believe that stocks of future sinful industries—sugary beverages, fast food/sugary food, biotech & pharmaceuticals and tech/social media—will eventually benefit from the sin stock anomaly once these industries are perceived as sinful by institutions and investors.

Since I cannot predict the future performance of these future sinful industries, I cannot definitively pinpoint the performance of portfolios of these sin stocks going forward. However, I analyzed the performance of portfolios of current sin stocks—alcohol and tobacco—before their industries were widely perceived as sinful, and after their industries were widely perceived as sinful. For these two industries, I have isolated a critical point in time in which I believe their industries became widely perceived as

sinful. From there, I examined the performance of portfolios of these two industries before and after that critical point in time. Once again, I created my portfolios with the same SIC codes, used the same linear regression models, and implemented the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum. After comparing the monthly alpha coefficient for both industries before and after the critical point in time in which they are recognized as sinful, I further bolstered my thesis. I found that portfolios of alcohol and tobacco stocks generated a statistically significant positive monthly alpha after they were perceived as sinful. More importantly, these portfolios of sin stocks generated larger levels of alpha after they were perceived as sinful—as compared to before they were perceived as sinful—by institutions and investors.

b. Event Studies

i. Tobacco Industry in U.S. Equity Markets

The tobacco industry, one of the three industries in the "triumvirate of sin," is the most commonly recognized sinful industry by both institutions and investors. Overwhelming research over the past century has cited the adverse health effects of using tobacco products—including lung and throat cancer, periodontal diseases, and coronary thrombosis (heart attack).[16] Despite the countless research done every year validating the adverse health effects of using tobacco products, cigarette and smokeless tobacco

[16] "Issue Health Effects," The Tobacco Atlas, accessed November 22, 2018, https://tobaccoatlas.org/topic/health-effects/.

companies continue to advertise their products, spending billions of dollars every year marketing their products.[17]

Despite the abundance of adverse news, tobacco companies continue to rake in billions of dollars in profit. A prime example of the exceptional performance of tobacco companies is Phillip Morris (ticker: PM.) A CNN article written in 2015 by Morgan Housel discusses the performance of the "most successful company in the world." Housel (2015) explains that $1 invested in Phillip Morris in 1968 was worth approximately $6,400 in 2015—a 639,000% increase over the time period. Housel also cites why tobacco stocks have done exceptionally well over time, including the fact that low investor demand keeps tobacco stock valuations low; he even claims that the more hated an investment is, the *higher* future returns are likely to be.

In order to compare the performance of the tobacco industry before and after it was widely perceived as sinful, I needed to pick a critical point in time in which the industry was widely viewed as sinful by both institutions and investors. In 1964, the Surgeon General of the United States published the following finding regarding cigarette smoking, "Cigarette smoking is *causally* related to lung cancer in men; the magnitude of the effect of cigarette smoking far outweighs all other factors. The data for women, though less extensive, point in the same direction."[18] This statement by the Surgeon General was one of the most critical points in time for people to perceive the tobacco

[17] "Tobacco Industry Marketing," Centers for Disease Control and Prevention, accessed November 22, 2018, https://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/marketing/index.htm.
[18] "The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General," National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, accessed November 23, 2018, https://www.ncbi.nlm.nih.gov/books/NBK294310/.

industry as sinful; however, this report by the Surgeon General was not the most significant point in time for deeming the tobacco industry sinful.

I believe that the Public Health Cigarette Smoking Act of 1970 was the most critical point in time for the tobacco industry to be perceived as sinful. The bill, which was signed by Richard Nixon in April 1970, banned cigarette companies from advertising their products on television and radio. Tobacco companies had been advertising their products on radio and television since WWII and their advertisements reached millions of Americans. I believe that this act is the critical point in time in which the tobacco industry is widely perceived as sinful for two reasons. First, this act was implemented by the U.S. government and the actions of the U.S. government exhibit the national efforts made by our country to help protect our citizens from dangerous products. Second, and more importantly, this act bolsters the claim made by the Surgeon General in 1964, validating the report and findings released to the public.

In order to support my hypothesis that portfolios of future sin stocks will generate larger excess returns once they are perceived as sinful, I compared the performance of portfolios of tobacco stocks from before and after 1970. I used the same SIC codes to construct my portfolio of tobacco stocks as I used in current sin stock analysis. However, I created two distinct tobacco portfolios—one with monthly returns from July 31, 1962 to March 31, 1970 (Portfolio 1) and one with monthly returns from April 30, 1970 to June 29, 2018 (Portfolio 2.) I used two capital asset pricing models to compare the performance of Portfolio 1 and Portfolio 2—the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum. I couldn't use the Fama-French 5 Factor Model to analyze the performance of the two portfolios because the Fama-French

database doesn't have profitability and investment factors dating back to the beginning of monthly returns for Portfolio 1.

When I ran my linear regression model using the Fama-French 3 Factor Model, Portfolio 1 generated a negative monthly alpha (-0.001.) This negative alpha was surprising to me—I had yet to see a portfolio of tobacco stocks in my all of my research generate a negative alpha coefficient. However, Portfolio 1 generated a t-stat of -0.45 and a P > |t| value of 0.654. From this model, we cannot reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

When I ran my linear regression using the Fama-French 3 Factor Model plus Momentum, Portfolio 1 generated a positive monthly alpha (0.001). I thought it was very fascinating to see this monthly become positive using this model, as the monthly alpha was negative using the Fama-French 3 Factor Model. Despite producing a positive monthly alpha, it generated a t-stat of 0.53 and a P > |t| of 0.597. Like the results I attained using the Fama-French 3 Factor Model, we cannot reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

The results were shocking when I transitioned to running my linear regression models on Portfolio 2. Once I ran my linear regression model using the Fama-French 3 Factor Model, Portfolio 2 generated a positive monthly alpha (0.009.) This positive monthly alpha was also statistically significant. It generated a t-stat of 5.09 and a P > |t| value of 0.000. These findings allow us to reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

The results were more shocking when I transitioned to running my linear regression model using the Fama-French 3 Factor Model plus Momentum. Portfolio 2

generated a positive monthly alpha (0.01.) This positive monthly alpha of 0.01 is incredibly large and shows the magnitude of the performance of this portfolio. More importantly, this large positive monthly alpha was also statistically significant. It generated a t-stat of 5.18 and a P > |t| of 0.000. Once again, these findings allow us to reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

Based on my data analysis, it is clear to see that Portfolio 2 generated a positive and statistically significant monthly alpha across the two capital asset pricing models after April 1970. In comparison, Portfolio 1 did produce any meaningful results across the two capital asset pricing models. It is clear to see that Portfolio 2 generated statistically significant levels of alpha across two factor models while Portfolio 1 did not. The results from Portfolio 2 support my hypothesis that portfolios of sin stocks generate larger levels of excess returns after they are perceived as sinful by institutions and investors.

ii. Alcohol Industry in U.S. Equity Markets

The alcohol industry, one of the other industries in the "triumvirate of sin," is another widely recognized sinful industry by both institutions and investors. Like the tobacco industry, countless research has been published exhibiting the adverse health effects associated with drinking alcohol, including heart damage, liver damage, and pancreas damage. Similarly, drinking alcohol has been studied and linked to numerous

kinds of cancer.[19] Like tobacco companies, alcohol companies in the U.S. spend hundreds of millions of dollars advertising their products across all different mediums. In 2016, approximately $1.59B was spent on beer advertising alone in the U.S. [20] Despite the adverse health effects associated with drinking alcohol, the alcohol industry continues to be one of the most profitable industries in the U.S. Since 2009, total alcoholic beverage sales in the U.S. have grown every year, totaling $234.4B in fiscal 2017.[21]

In order to compare the performance of the alcohol industry before and after it was widely perceived as sinful, I needed to pick a critical point in time in which the industry was widely viewed as sinful by both institutions and investors. I believe that the Alcoholic Beverage Labeling Act of 1988 is the critical point in time in which the alcohol industry was widely perceived by both institutions and investors. The act required labels of alcoholic beverages to carry the following government warning:

> GOVERNMENT WARNING:
>
> (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects.
>
> (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery, and may cause health problems.[22]

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[19] "Alcohol's Effect on the Body," National Institute on Alcohol Abuse and Alcoholism, accessed November 23, 2018, https://www.niaaa.nih.gov/alcohol-health/alcohols-effects-body.
[20] "Traditional media advertising spending on alcoholic beverages in the United States in 2016, by category (in million U.S. dollars), Statista, accessed November 23, 2018, https://www.statista.com/statistics/748562/alcoholic-beverage-ad-spend-category-us/.
[21]"Total alcoholic beverage sales in the United States from 2006 to 2017 (in million U.S. dollars), Statista, accessed November 23, 2018, https://www.statista.com/statistics/207936/us-total-alcoholic-beverages-sales-since-1990/.
[22]"S.2047 – Alcoholic Beverage Labeling Act of 1988," Congress.Gov., accessed November 25, 2018, https://www.congress.gov/bill/100th-congress/senate-bill/2047.

Similarly, the mission statement of the act stated, "the American public should be informed about the health hazards that may result from the consumption or abuse of alcoholic beverages, and has determined that it would be beneficial to provide a clear, nonconfusing reminder of such hazards, and that there is a need for national uniformity in such reminders in order to avoid the promulgation of incorrect or misleading information and to minimize burdens on interstate commerce."[23] I believe that this act is the clearest example of the alcohol industry being recognized as sinful. The fact that the U.S. government mandated all U.S. alcoholic beverages manufactures to list the adverse health effects associated with drinking their products exhibits the sinful nature of their products.

In order to support my hypothesis that portfolios of future sin stocks will generate larger—and positive—abnormal returns once they are widely perceived as sinful, I compared the performance of portfolios of alcohol stocks from before and after 1988. I used the same SIC codes to construct my portfolio of alcohol stocks as I used in current sin stock analysis. However, I created two distinct alcohol portfolios—one with monthly returns from June 30, 1936 to January 29, 1988 (Portfolio 3) and one with monthly returns from February 29, 1988 to June 29, 2018 (Portfolio 4.) I used two capital asset pricing models to compare the performance of Portfolio 3 and Portfolio 4—the Fama-French 3 Factor Model and the Fama-French 3 Factor Model plus Momentum. I couldn't use the Fama-French 5 Factor Model to analyze the performance of the two portfolios because the Fama-French database doesn't have profitability and investment factors dating back to the beginning of monthly returns for Portfolio 3.

[23] "27 U.S. Code § 213 - Declaration of Policy and Purpose | US Law | LII / Legal Information Institute," accessed December 7, 2018, https://www.law.cornell.edu/uscode/text/27/213.

When I ran my linear regression model using the Fama-French 3 Factor Model, Portfolio 3 generated a positive monthly alpha (0.003.) Similarly, Portfolio 3 generated a t-stat of 1.65 and a P > |t| value of 0.100. From this model, we cannot reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

When I ran my linear regression using the Fama-French 3 Factor Model plus Momentum, Portfolio 3 generated a positive monthly alpha (0.003). Despite producing a positive monthly alpha, it generated a t-stat of 1.79 and a P > |t| of 0.074. Like the results I attained using the Fama-French 3 Factor Model, we cannot reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

When I transitioned to running my linear regression models on Portfolio 4, the results were very different. Once I ran my linear regression model using the Fama-French 3 Factor Model, Portfolio 4 generated a positive monthly alpha (0.007.) This positive monthly alpha was also statistically significant. It generated a t-stat of 3.71 and a P > |t| value of 0.000. These findings allow us to reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

The results were even more surprising when I transitioned to running my linear regression model using the Fama-French 3 Factor Model plus Momentum. Portfolio 4 generated a positive monthly alpha (0.008). This positive monthly alpha of 0.008 is very large and shows the magnitude of the performance of this portfolio after 1988. More importantly, this large positive monthly alpha was also statistically significant. It generated a t-stat of 3.81 and a P > |t| of 0.000. Once again, these findings allow us to reject the null hypothesis that the monthly alpha coefficient is zero with a 95% confidence interval.

Based on my data analysis, it is clear to see that Portfolio 4 generated a positive and statistically significant monthly alpha across the two capital asset pricing models after April 1970. In comparison, Portfolio 3 did produce any meaningful results across the two capital asset pricing models. It is clear to see that Portfolio 4 generated statistically significant levels of alpha across two factor models while Portfolio 3 did not. The results from Portfolio 4 support my hypothesis that portfolios of sin stocks generate larger levels of excess returns after they are perceived as sinful by institutions and investors.

iii. Conclusion from Alcohol and Tobacco Event Studies

In my thesis, I argue that the growth of socially responsible investing practices in U.S. equity markets will cause four industries—sugary beverages, fast food/sugary food, biotech & pharmaceuticals and tech/social media—to eventually be perceived as sinful and grouped with the current sinful industries—alcohol, tobacco, gaming and aerospace & defense. Once these industries are widely perceived as sinful by both institutions and investors, portfolios of these stocks will generate larger positive abnormal returns after being perceived as sinful as compared to before they were perceived as sinful. Since I cannot predict the future performance of these industries, I thought that the two event studies of alcohol and tobacco would help shine light on what would potentially happen to these industries once they are widely perceived as sinful. In both event studies, it was clear to see that portfolios of tobacco (Portfolio 2) and alcohol (Portfolio 4) generated positive and statistically significant alphas after being recognized sinful as compared to

before they were recognized as sinful (Portfolios 1 &3.) These two event studies support my argument that portfolios of sin stocks generate larger and positive excess returns after they are widely perceived as sinful.

These two event studies bolster my argument that investing in these future sin stocks will be a viable and profitable investment strategy in the immediate and foreseeable future. Portfolios of sugary beverages and fast food/sugary food produced a positive and statistically significant monthly alpha when regressed on the Fama-French 3 Factor Model and the Fama-French 3-Factor Model plus Momentum. Portfolios of biotech & pharmaceutical companies and tech/social media companies produced a positive and statistically significant alpha when regressed on all three capital asset pricing models I use. Since these portfolios generate alpha now, and I have proven that portfolios of sin stocks generate larger and statistically significant levels of alpha after their industries are widely perceived as sinful, investing in these future sinful industries will be a profitable investment strategy in the short and long term horizon.

8. Conclusion

In my Senior Thesis, I wanted to explore how the growth of socially responsible investing practices in U.S. equity markets would impact sin stock performance. Similarly, I wanted to explore the performance of portfolios of sin stocks, as there has been conflicting literature about the existence of the sin stock anomaly. I also wanted to examine the performance of socially responsible ETFs to see if investing in socially responsible investment vehicles would generate some positive abnormal return over a

common benchmark. Furthermore, I hypothesized that as socially responsible investing practices in U.S. equity markets continue to grow, there were going to be more industries that are going to be perceived as sinful by both institutions and investors. I believe that eventually the sugary beverages industry, fast food/sugary food industry, biotech & pharmaceutical industry and the tech/social media industry will all be recognized as sinful. If I could prove to some degree the sin stock anomaly existed, a profitable investment strategy of investing in these future sin stocks would be profitable and viable in both the short and long term time horizon.

In my analysis of socially responsible ETFs, I wanted to see the performance of these ETFs and examine if any abnormal returns were generated from investing in them. Based on my findings, only *one* socially responsible ETF (CRBN) generated a positive and statistically significant alpha. However, this ETF was the newest ETF to be constructed out of my sample and its performance is explained by Dan Weil's (2018) WSJ article showing a positive correlation between the ETFs' months since inception and the positive excess return generated. Most of the socially responsible ETFs did not generate any meaningful nor statistically significant alpha across all factor models. Furthermore, two of my socially responsible ETFs produced a statistically significant but *negative* alpha—implying that these ETFs had generated negative returns since their inception. From this data analysis, I conclude that it is essentially meaningless to invest in these socially responsible securities—investors are better off investing in a market ETF and until these ETFs can consistently beat the market, these ETFs should be avoided.

In my analysis of current sin stocks, I wanted to see if I could prove the existence of the sin stock anomaly. I created equal-weighted portfolios of current sin stocks based on

SIC codes and used existing capital asset pricing models to see if they generated alpha. Every single equal-weighted portfolio of current sin stocks generated a positive and statistically significant monthly alpha across all factor models (except for gaming with the Fama-French 5 Factor Model). Virtually every single equal-weighted portfolio of current sin stocks generated a positive and statistically significant monthly alpha across all factor models. I believe that these findings prove the existence of the sin stock anomaly.

In my analysis of what I believe to be future sin stocks, I aimed at exploring the performance of these industries before they were widely perceived as sinful. Across all factor models, equal-weighted portfolios of biotech & pharmaceutical stocks and tech/social media stocks generated a positive and statistically significant monthly alpha coefficient. Equal-weighted portfolios of sugary beverage stocks and fast food/sugary food stocks exhibited a positive and statistically significant monthly alpha across all factor models except the Fama-French 5 Factor Model. The results from my analysis of future sin stocks reveal that equal-weighted portfolios of these future sin stocks, in almost all instances, have generated some form of positive and statistically significant alpha in the past. These results, paired along with the evidence of the sin stock anomaly, showcase a viable and profitable investment strategy in the short and long term time horizon.

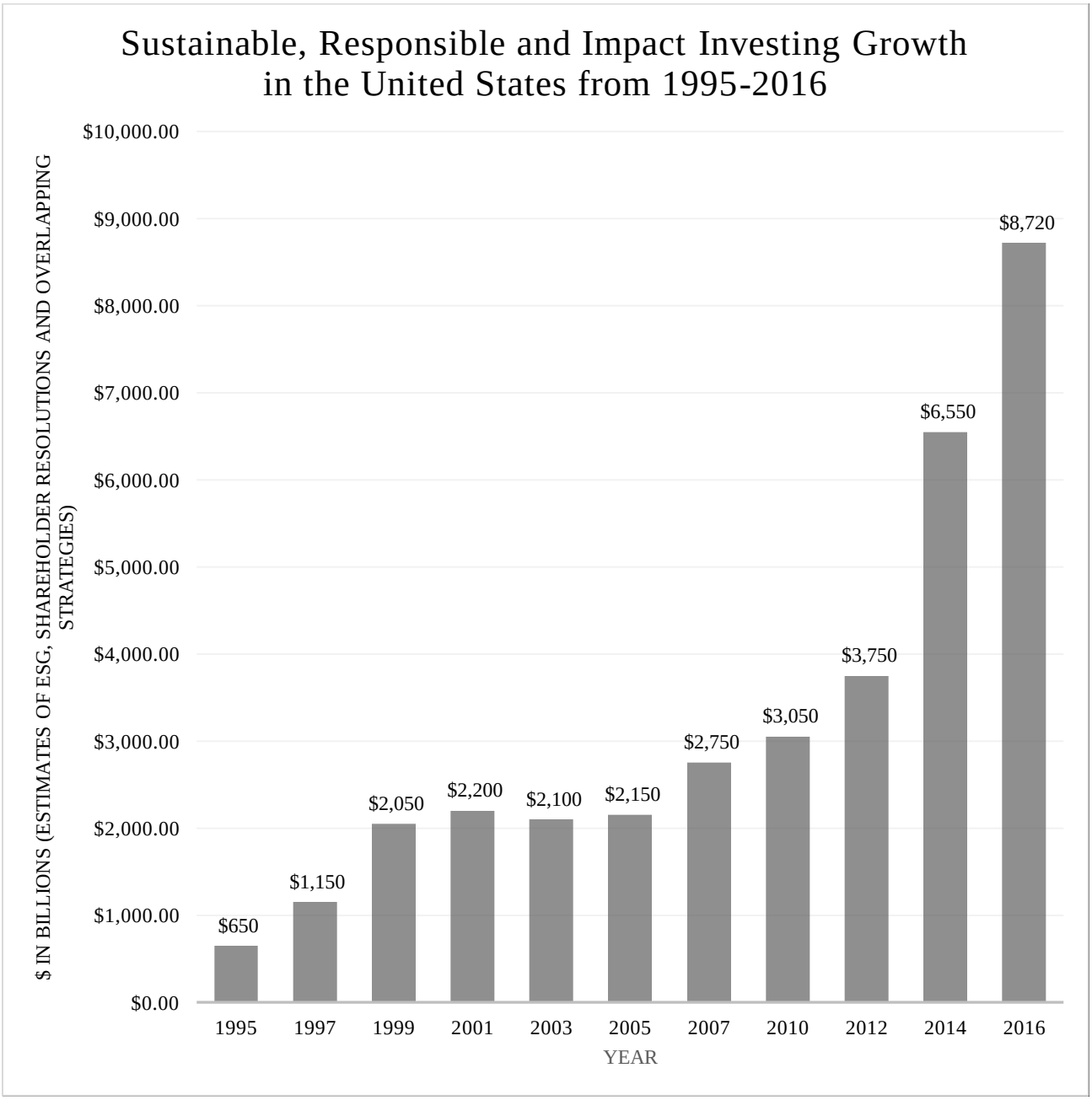
Finally, I wanted to see how equal-weighted portfolios of current sinful industries—alcohol and tobacco—performed before and after they were widely perceived as sinful. I used the same portfolio construction and factor models in my current and future sin stock analysis. The goal of these event studies was to further bolster my argument that investing in these future sin stocks will be a profitable investment strategy in the short

and long term time horizon. By choosing a critical point in time in which I believe these industries were widely perceived as sinful, I then compared their performance before and after the event. In both event studies, and across all factor models used, equal-weighted portfolios of alcohol and tobacco stocks showed a positive and statistically significant alpha *after* they were perceived as sinful, as compared to before they were perceived as sinful. These findings support my central hypothesis to my paper and ultimately connect the two distinct topics of my study—socially responsible investing and investing in sin stocks.

These two distinct areas of portfolio management are fascinating because both incorporate ideas that are not normally associated with portfolio management theory—including social norms, ethical constraints and moral constraints. These two areas of portfolio management are a hot-topic issue. Both ask the question, *why should I care about what I invest in?* This question then brings up the idea that you either benefit from investing a certain way, or you become impaired from investing a certain way. Based on my analysis, investors benefit from investing in sin stocks. Portfolios of these stocks have generated positive and statistically significant monthly alpha when regressed on numerous factor models. On the other hand, investors seem to be impaired by investing in socially responsible ETFs as most have not beat the market since their inception. Despite the impairment that arises due to socially responsible investing, it has continuously grown in U.S. equity markets over the past 15 years. Similarly, despite the benefit of investing in sin stocks, it has become increasingly taboo to invest in these companies. These two monumental trends create an instrumental question that needs to be addressed: *how will the growth of socially responsible investing affect sin stocks going forward in*

U.S. equity markets? Based on my results, the answer is clear—once these industries are perceived as sinful in U.S. equity markets, portfolios of these stocks will generate larger, positive, and statistically significant levels of alpha than before their industries were perceived as sinful. I am not advocating for investing in morally or ethically hazardous industries. What I will say is that each investor needs to decide how far their moral and ethical values will affect their investment choices and their portfolio construction.

Figure 1: Sustainable, Responsible and Impact Investing Growth in the United States from 1995-2016



Source: https://www.ussif.org/files/SIF_Trends_16_Executive_Summary(1).pdf

Figure 2: Total Returns of My Socially Responsible ETFs and Comparables since Their Inceptions

Ticker	Inception Date	Total Return* Since Inception
DSI	November 14, 2006	8.11%
SUSA	January 24, 2005	8.27%
CRBN	December 8, 2014	8.16%
EQLT	February 24, 2014	10.91%
QCLN	February 8, 2007	0.34%
VICEX	September 30, 2002	9.69%**
S&P 500 TR	January 4, 1988	12.71%***

*Total Return represents changes to NAV and accounts for distributions from the funds

** https://usamutuals.com/vice-fund/

*** https://finance.yahoo.com/quote/%5ESP500TR/history?p=%5ESP500TR

DSI

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.969	.040	23.83	0.000	.889	1.05
SMB	-.072	.030	-2.35	0.020	-.133	-.011
HML	.034	.060	0.57	0.571	-.0856	.154
Alpha	.0008	.001	0.79	0.429	-.001	.002

DSI

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.968	.039	24.23	0.000	.889	1.04
SMB	-.072	.030	-2.34	0.021	-.133	-.011
HML	.031	.063	0.50	0.616	-.093	.157
UMD	-.003	.019	-0.21	0.837	-.041	.033
Alpha	.0008	.001	0.80	0.427	-.002	.002

DSI

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.981	.037	25.98	0.000	.907	1.05
SMB	-.063	.033	-1.89	0.061	-.129	.002
HML	.023	.057	0.41	0.686	-.089	.136
CMA	.065	.082	0.79	0.430	-.098	.229
RMW	.068	.062	1.11	0.270	-.053	.191
Alpha	.0005	.001	0.51	0.610	-.001	.002

SUSA

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.993	.018	52.80	0.000	.956	1.03
SMB	-.106	.027	-3.85	0.000	-.160	-.051
HML	-.037	.025	-1.45	0.150	-.087	.013
Alpha	-.001	.000	-1.68	0.096	-.002	.0001

SUSA

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.988	.019	50.54	0.000	.950	1.02
SMB	-.102	.027	-3.85	0.000	-.159	-.051
HML	-.048	.027	-1.78	0.078	-.102	.005
UMD	-.010	.012	-1.46	0.145	-.043	.006
Alpha	-.001	.0006	-1.61	0.110	-.002	.0002

SUSA

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.00	.018	53.27	0.000	.966	1.04
SMB	-.096	.026	-3.61	0.000	-.148	-.043
HML	-.040	.031	-1.28	0.203	-.102	.021
CMA	.042	.054	0.79	0.428	-.062	.147
RMW	.070	.047	1.50	0.136	-.022	.163
Alpha	-.001	.0006	-2.01	0.046	-.002	-.00002

QCLN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.56	.114	13.68	0.000	1.34	1.79
SMB	.591	.176	3.35	0.001	.242	.941
HML	-.475	.170	-2.78	0.006	-.813	-.137
Alpha	-.008	.004	-1.94	0.0054	-.017	.0001

QCLN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.55	.124	12.50	0.000	1.30	1.80
SMB	.591	.175	3.36	0.001	.243	.939
HML	-.504	.166	-3.03	0.003	-.833	-.174
UMD	-.043	.102	-0.42	0.675	-.245	.159
Alpha	-.008	.004	-1.92	0.058	-.017	.0002

QCLN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.410	.113	12.43	0.000	1.18	1.63
SMB	.613	.186	3.29	0.001	.245	.981
HML	-.062	.202	-0.30	0.762	-.470	.345
CMA	-1.16	.284	-4.10	0.000	-1.72	-.602
RMW	-.149	.294	-0.51	0.612	-.731	.432
Alpha	-.006	.004	-1.45	0.149	-.015	.002

CRBN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	-.120	.175	-0.69	0.497	-.475	.234
SMB	.101	.191	0.53	0.600	-.286	.488
HML	.129	.166	0.78	0.440	-.206	.466
Alpha	.008	.005	1.40	0.168	-.004	.201

CRBN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	-.182	.205	-0.89	0.380	-.599	.233
SMB	.078	.181	0.43	0.668	-.289	.446
HML	.016	.181	0.09	0.929	-.351	.384
UMD	-.172	.198	-0.87	0.392	-.574	.230
Alpha	.009	.006	1.52	0.138	-.003	.021

CRBN

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	-.012	.186	-0.07	0.948	-.390	.366
SMB	.367	.201	1.82	0.076	-.040	.775
HML	.170	.250	0.68	0.500	-.336	.677
CMA	.453	.396	1.15	0.259	-.348	1.25
RMW	1.12	.420	2.68	0.011	.275	1.98
Alpha	.008	.005	1.44	0.158	-.003	.019

EQLT

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.985	.070	13.98	0.000	.843	1.12
SMB	.079	.075	1.06	0.296	-.072	.231
HML	.044	.088	0.51	0.616	-.132	.222
Alpha	.0004	.002	0.20	0.843	-.004	.005

EQLT

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.934	.082	11.26	0.000	.767	1.10
SMB	.076	.079	0.96	0.341	-.083	.235
HML	-.064	.114	-0.56	0.578	-.294	.166
UMD	-.157	.082	-1.91	0.062	-.322	.007
Alpha	.001	.002	0.48	0.633	-.003	.005

EQLT

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.00	.068	14.62	0.000	.867	1.14
SMB	.114	.081	1.40	0.167	-.049	.278
HML	-.006	.141	-0.04	0.966	-.291	.279
CMA	.181	.267	0.68	0.501	-.357	.720
RMW	.130	.147	0.89	0.379	-.166	.427
Alpha	.0004	.002	0.20	0.844	-.004	.005

VICEX

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.917	.065	14.03	0.000	.788	1.04
SMB	-.138	.091	-1.51	0.132	-.317	.041
HML	-.210	.113	-1.86	0.065	-.434	.013
Alpha	.002	.002	0.97	0.332	-.002	.006

VICEX

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.934	.059	15.79	0.000	.817	1.05
SMB	-.143	.089	-1.59	0.112	-.320	.034
HML	-.188	.123	-1.53	0.128	-.432	.054
UMD	.045	.057	0.79	0.432	-.068	.159
Alpha	.002	.002	0.93	0.355	-.002	.006

VICEX

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.928	.055	16.69	0.000	.818	1.03
SMB	-.107	.106	-1.01	0.316	-.318	.103
HML	-.148	.131	-1.13	0.260	-.408	.111
CMA	-.150	.166	-0.91	0.366	-.479	.177
RMW	.166	.162	1.02	0.308	-.154	.486
Alpha	.001	.002	0.71	0.481	-.002	.006

Alcohol

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.866	.050	17.11	0.000	.766	.965
SMB	.152	.077	1.97	0.050	.0008	.305
HML	.378	.082	4.57	0.000	.215	.541
Alpha	.006	.001	4.01	0.000	.003	.010

Alcohol

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.858	.046	18.30	0.000	.766	.951
SMB	.155	.076	2.03	0.043	.005	.306
HML	.362	.074	4.90	0.000	.217	.508
UMD	-.039	.081	-0.49	0.624	-.200	.120
Alpha	.007	.001	3.85	0.000	.003	.010

Alcohol

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.867	.067	12.88	0.000	.735	1.00
SMB	.139	.085	1.63	0.104	-.028	.307
HML	.353	.139	2.54	0.012	.079	.627
CMA	.049	.141	0.35	0.729	-.228	.327
RMW	.380	.122	3.10	0.002	.139	.622
Alpha	.005	.002	2.63	0.009	.001	.009

Tobacco

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.745	.057	12.87	0.000	.631	.859
SMB	.009	.088	0.11	0.912	-.163	.183
HML	.251	.101	2.49	0.013	.052	.449
Alpha	.010	.002	4.97	0.000	.006	.014

Tobacco

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.733	.058	12.50	0.000	.618	.849
SMB	.014	.087	0.17	0.863	-.155	.185
HML	.226	.108	2.09	0.037	.013	.440
UMD	-.061	.068	-0.90	0.371	-.195	.073
Alpha	.011	.002	4.95	0.000	.006	.015

Tobacco

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.835	.084	9.92	0.000	.670	1.00
SMB	.137	.111	1.23	0.218	-.081	.356
HML	.019	.159	0.12	0.905	-.295	.333
CMA	.344	.193	1.78	0.076	-.035	.723
RMW	.548	.162	3.38	0.001	.228	.867
Alpha	.006	.002	2.12	0.035	.0004	.011

Gaming

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.08	.062	17.36	0.000	.960	1.20
SMB	.745	.100	7.40	0.000	.547	.942
HML	.635	.106	5.99	0.000	.426	.843
Alpha	.004	.001	2.85	0.004	.001	.008

Gaming

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.03	.045	22.77	0.000	.944	1.12
SMB	.767	.086	8.87	0.000	.597	.937
HML	.531	.078	6.76	0.000	.376	.685
UMD	-.262	.097	-2.70	0.007	-.453	-.071
Alpha	.006	.001	3.60	0.000	.003	.010

Gaming

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.15	.076	15.09	0.000	1.00	1.30
SMB	.729	.100	7.23	0.000	.531	.928
HML	.801	.171	4.67	0.000	.463	1.13
CMA	-.251	.157	-1.60	0.110	-.561	.057
RMW	.449	.138	3.24	0.001	.176	.722
Alpha	.001	.001	0.54	0.589	-.002	.005

Aerospace & Defense

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.16	.047	24.66	0.000	1.07	1.25
SMB	.807	.113	7.09	0.000	.583	1.03
HML	-.027	.086	-0.32	0.751	-.197	.142
Alpha	.006	.001	4.27	0.000	.003	.010

Aerospace & Defense

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.11	.048	23.20	0.000	1.02	1.21
SMB	.827	.103	7.99	0.000	.623	1.03
HML	-.118	.088	-1.35	0.179	-.292	.054
UMD	-.230	.068	-3.35	0.001	-.366	-.095
Alpha	.008	.001	5.01	0.000	.005	.012

Aerospace & Defense

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.993	.070	14.08	0.000	.854	1.13
SMB	.595	.108	5.50	0.000	.382	.808
HML	.386	.152	2.54	0.012	.087	.686
CMA	-.608	.212	-2.86	0.005	-1.02	-.189
RMW	-.278	.152	-1.82	0.069	-.579	.022
Alpha	.009	.002	3.96	0.000	.004	.013

Soda/Sugary Beverages

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.912	.063	14.37	0.000	.788	1.03
SMB	.585	.096	6.09	0.000	.396	.774
HML	.415	.110	3.76	0.000	.198	.633
Alpha	.003	.001	2.01	0.045	.00006	.006

Soda/Sugary Beverages

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.870	.047	18.53	0.000	.778	.963
SMB	.604	.087	6.87	0.000	.431	.776
HML	.327	.080	4.08	0.000	.169	.485
UMD	-.222	.117	-1.89	0.060	-.454	.008
Alpha	.004	.001	2.50	0.013	.001	.008

Soda/Sugary Beverages

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.943	.078	11.96	0.000	.788	1.09
SMB	.640	.109	5.86	0.000	.425	.856
HML	.543	.180	3.02	0.003	.188	.898
CMA	-.127	.142	-0.89	0.375	-.408	.154
RMW	.561	.134	4.16	0.000	.295	.826
Alpha	.0008	.001	0.43	0.670	-.002	0.004

Fast Food/Sugary Food Companies

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.852	.056	14.98	0.000	.740	.964
SMB	.529	.087	6.06	0.000	.357	.701
HML	.437	.099	4.42	0.000	.242	.631
Alpha	.003	.001	2.22	0.027	.0003	.006

Fast Food/Sugary Food Companies

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.816	.044	18.42	0.000	.729	.903
SMB	.545	.080	6.76	0.000	.386	.704
HML	.362	.073	4.91	0.000	.217	.507
UMD	-.189	.102	-1.84	0.066	-.391	.012
Alpha	.004	.001	2.63	0.009	.001	.008

Fast Food/Sugary Food Companies

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.874	.069	12.52	0.000	.736	1.01
SMB	.618	.096	6.42	0.000	.429	.808
HML	.528	.162	3.26	0.001	.209	.847
CMA	-.073	.135	-0.55	0.586	-.339	.191
RMW	.584	.121	4.83	0.000	.345	.822
Alpha	.0005	.001	0.33	0.744	-.002	.004

Biotech & Pharmaceuticals

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.05	.048	21.92	0.000	.961	1.15
SMB	.708	.072	9.74	0.000	.565	.851
HML	-.108	.086	-1.25	0.211	-.278	.061
Alpha	.008	.001	4.68	0.000	.004	.011

Biotech & Pharmaceuticals

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.02	.046	21.98	0.000	.934	1.11
SMB	.722	.072	9.97	0.000	.579	.864
HML	-.172	.086	-1.98	0.048	-.343	-.001
UMD	-.161	.059	-2.72	0.007	-.277	-.044
Alpha	.009	.001	5.03	0.000	.005	.013

Biotech & Pharmaceuticals

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.11	.065	16.91	0.000	.986	1.24
SMB	.606	.094	6.40	0.000	.420	.793
HML	-.218	.147	-1.47	0.141	-.509	.072
CMA	.152	.157	0.97	0.333	-.157	.461
RMW	-.280	.130	-2.14	0.033	-.537	-.022
Alpha	.007	.002	2.87	0.004	.002	.012

Tech/Social Media

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.13	.058	19.42	0.000	1.02	1.25
SMB	.798	.176	4.52	0.000	.451	1.14
HML	-.221	.111	-2.00	0.047	-.440	-.003
Alpha	.006	.002	3.32	0.001	.002	.010

Tech/Social Media

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	1.07	.054	19.84	0.000	.967	1.18
SMB	.827	.160	5.15	0.000	.511	1.14
HML	-.356	.102	-3.47	0.001	-.559	-.154
UMD	-.341	.077	-4.43	0.000	-.493	-.190
Alpha	.009	.002	4.46	0.000	.005	.013

Tech/Social Media

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.998	.088	11.27	0.000	.824	1.17
SMB	.630	.183	3.44	0.001	.269	.991
HML	.200	.197	1.02	0.310	-.187	.588
CMA	-.717	.250	-2.87	0.004	-1.21	-.225
RMW	-.201	.203	-0.99	0.323	-.602	.199
Alpha	.007	.003	2.60	0.010	.001	.013

TOBACCO CASE STUDY

Before: 3 Factor Model (Portfolio 1)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.544	.102	5.32	0.000	.340	.747
SMB	.556	.149	3.72	0.000	.259	.854
HML	.634	.175	3.62	0.000	.285	.989
Alpha	-.001	.003	-0.45	0.654	-.007	.004

Before: 3 Factor Model plus Momentum (Portfolio 1)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.517	.100	5.16	0.000	.318	.717
SMB	.642	.135	4.75	0.000	.373	.912
HML	.511	.159	3.21	0.002	.194	.827
UMD	-.362	.111	-3.27	0.002	-.583	-.142
Alpha	.001	.003	0.53	0.597	-.004	.007

After: 3 Factor Model (Portfolio 2)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.766	.054	14.11	0.000	.659	.872
SMB	.306	.100	3.06	0.002	.109	.503
HML	.1023	.084	1.21	0.225	-.063	.267
Alpha	.009	.001	5.09	0.000	.005	.013

After: 3 Factor Model plus Momentum (Portfolio 2)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.748	.053	14.04	0.000	.643	.853
SMB	.275	.100	2.74	0.006	.077	.472
HML	.099	.081	1.23	0.219	-.059	.259
UMD	-.085	.062	-1.37	0.171	-.208	.037
Alpha	.010	.001	5.18	0.000	.006	.014

ALCOHOL CASE STUDY

Before: 3 Factor Model (Portfolio 3)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.895	.064	13.99	0.000	.769	1.02
SMB	.660	.095	6.92	0.000	.472	.847
HML	.296	.126	2.34	0.020	.047	.546
Alpha	.003	.001	1.65	0.100	-.0006	.007

Before: 3 Factor Model plus Momentum (Portfolio 3)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.894	.063	14.20	0.000	.770	1.01
SMB	.654	.091	7.19	0.000	.475	.834
HML	.285	.116	2.45	0.015	.055	.516
UMD	-.039	.080	-0.49	0.623	-.198	.118
Alpha	.003	.002	1.79	0.074	-.003	.007

After: 3 Factor Model (Portfolio 4)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.801	.062	12.90	0.000	.679	.924
SMB	.042	.079	0.54	0.592	-.113	.198
HML	.407	.095	4.28	0.000	.220	.594
Alpha	.007	.001	3.71	0.000	.003	.011

After: 3 Factor Model plus Momentum (Portfolio 4)

Independent Variables	Coefficient	Std. Error	t-stat	P > |t|	95% Confidence Interval	95% Confidence Interval
Market	.763	.053	14.20	0.000	.657	.869
SMB	.049	.070	0.67	0.506	-.097	.197
HML	.364	.080	4.54	0.000	.206	.522
UMD	-.115	.090	-1.28	0.202	-.293	.062
Alpha	.008	.002	3.81	0.000	.003	.012

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