The Growth, Development, and Performance of Socially Responsible Exchange-Traded Funds

Hunter Shelton

University of Maryland, Baltimore County (UMBC)

Abstract

Using monthly return data from 2009 to 2018, this study examines the performance of eleven socially responsible exchange-traded funds (ETFs). The analysis examines the Sharpe ratio of each ETF and calculates Jensen's alpha from the basic and extended versions of the CAPM model. The results indicate that ten of the eleven ETFs provided negative excess returns, nine of which were significantly negative. The only ETF that provided positive excess returns is significant at the 10% level. The majority of the socially responsible ETFs that provided subpar returns did so due to the underperformance of the renewable energy industry.

Introduction

The key advantage of exchange-traded funds (ETFs) is that they allow investors the ability to customize their portfolios without having to meet the minimum initial investment requirements of many mutual funds or pick specific stocks in an industry. As socially responsible investing (SRI) became increasingly popular during the past decade, it was inevitable that socially responsible ETFs would be created. However, all the studies on the performance of SRI has been done on mutual funds. This can be attributed to many socially responsible ETFs being relatively new. Although socially responsible ETFs account for a small percentage of total ETF and SRI, the $10 billion invested in socially responsible ETFs is still a significant amount. Since both industries have seen accelerated growth in the past decade, it is important to analyze the impact it will have as more individuals begin investing in these vehicles.

Modern SRI originated during the early 1900s from churches who wished to support projects that were aligned with their values and still provide a return to its investors. The churches often developed portfolios using an avoidance approach (Sparkes and Cowton, 2004). The funds were structured similar to a typical diversified portfolio, but the portfolio excluded companies in industries deemed unethical by the church such as alcohol, tobacco, and gaming. The terminology gravitated towards SRI around 2000 since designating specific investment practices as ethical implied that other practices were unethical.

Although ETFs existed for nearly three decades, the limited use during the early stages of their development resulted in few studies about them. However, their accelerated growth in recent years has led to a corresponding growth in the volume of its literature. Most of the literature regarding the performance of ETFs revolves around comparisons to mutual funds or

the performance of recently developed actively managed ETFs. Occasionally studies will explain the history and development of ETFs (Gastineau, 2001; Ferri, 2008), but these need to be regularly updated due to the constant evolution of the ETF industry. Despite the growth in literature, there are still holes that need to be filled.

This paper has updated the history of ETFs with the development of actively managed ETFs and growth of socially responsible ETFs. Additionally, this study briefly looks at the current state of the ETF market and postulates theories as to why certain managers have been successful in the market. There do not appear to be prior studies that examine the concentration of the ETF market. The ETF market could be an avenue for studying the effect of a brand on consumer choices. It could also be the result of economies of scale if the major fund managers are able to provide lower expense ratios due to efficient management.

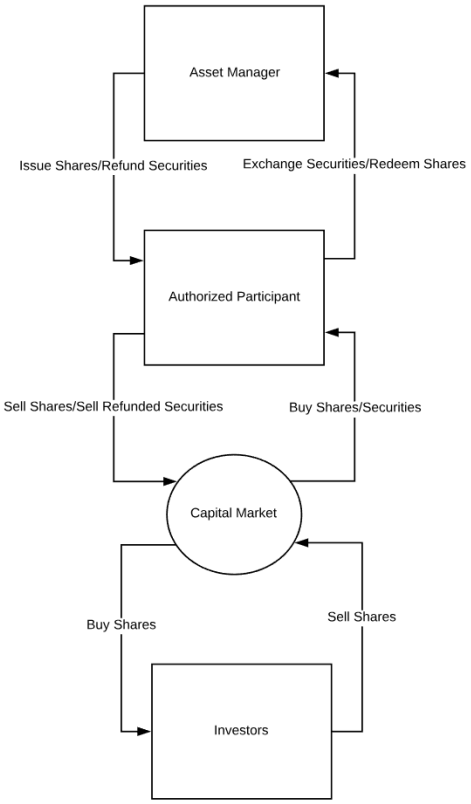
The study will also examine the performance of socially responsible ETFs. Consistent with past studies, the performance of the socially responsible ETFs will be analyzed through the combination of the Sharpe ratio, the capital asset pricing model (CAPM) model, the Fama and French 3-factor model, and the Carhart 4-factor model. This study incorporates data from 2009 through 2018. Due to nearly all of the data occurring during an economic expansion in the United States, the study provides insight into how SRI performs during an expansion. The performance of socially responsible ETFs will provide evidence as to whether or not investors are willing to pay a premium to invest in companies that share their ethical values.

Background

ETFs act as a combination of a closed-end mutual fund and an open-end mutual fund. A closed end mutual fund issues a fixed number of shares during an initial offering period. These

shares can then be traded on a secondary market after the initial offering period has ended. Thus, as the value of the underlying assets of the mutual fund increase, then the value of the shares increase. An open-end mutual fund does not have a fixed number of shares assigned to the fund, but it does not allow shares to be traded on a secondary market. Investor can only invest and disinvest from an open-end mutual fund by buying new shares or selling old shares directly through the mutual fund. This arbitrage process is known as the creation and redemption process and is a key framework of ETFs.

ETFs combine the ability to trade shares from closed-end mutual funds with the creation and redemption process of open-end mutual funds through the use of authorized participants (APs). The process is diagrammed in Figure 1 (Lettau & Madhaven, 2018). Perhaps the best way to explain the creation and redemption process is through an example. Suppose an ETF is trading at a price below the net asset value of the underlying assets it represents. APs will



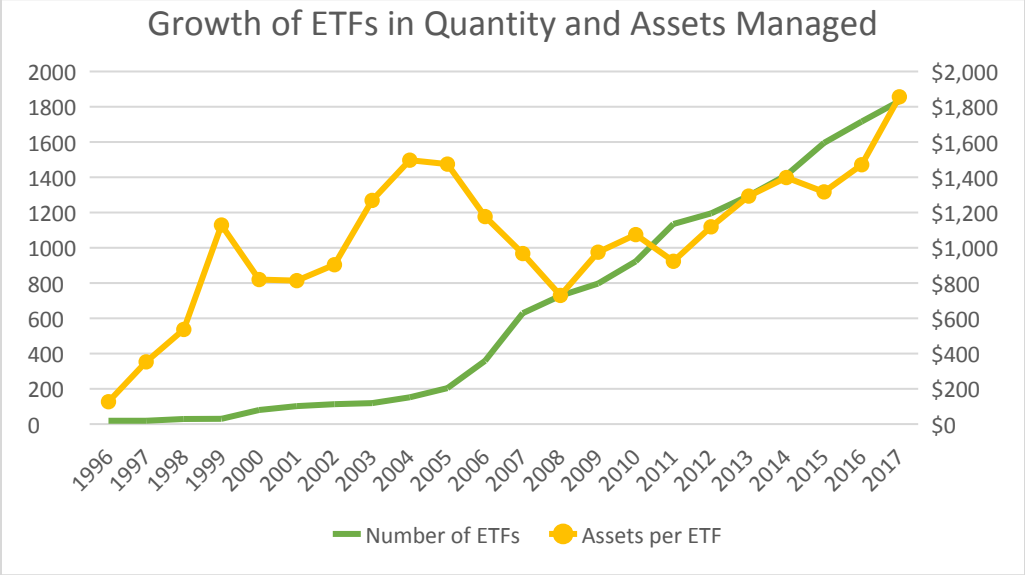
purchase the ETF shares on the capital market and redeem them with the issuer of the ETFs in exchange for the underlying assets of the shares. Thus, the APs are able to make a small risk-free profit, and the price an ETF will rise until it reaches the net asset value of the underlying assets.

The security that is widely considered to be the first ETF was launched by State Street Global Advisors (State Street) in 1993 and is the Standard and Poor's Depository Receipts (SPDR), often called spiders. However, SPDRs were not the first attempt to create a security that represented a basket of other securities and be traded on stock exchanges. Before SPDRs, the trading of a basket of securities originated in the late 1970s through portfolio trading (Gastineau, 2001). Portfolio trading was still relatively expensive and only practical for institutional investors. The demand for a smaller and relatively cheaper method of trading baskets of securities led to the development of Index Participation Shares, Toronto Stock Exchange Index Participations, and Supershares or SuperUnits (Gastineau, 2001). Each of these innovations were discontinued due to either legality problems, practicality, or complexity.

The rest of the 1990s featured a small number of banks competing to introduce the next innovation of ETFs. A combination of Morgan Stanley and Barclays Global Investors created the World Equity Benchmark Shares to track thirteen different equity markets around the world (Ferri, 2008). State Street countered by introducing a new ETF to track the Dow Jones Industrial Average as well as nine new ETFs to track nine different sectors by using stocks that are a part of the S&P 500. Additionally, Investment Product Services created an ETF to track the NASDAQ-100 during 1998 and was known by its ticker QQQ (Investment Product Services Inc., 1998). The tech boom of the late 1990s drove many investors to invest in QQQ and brought attention to

ETFs (Ferri, 2008). However, the collapse of the tech bubble in 2000 hurt QQQ and stifled the amount of money being invested in ETFs (Ferri, 2008).

Most of the 2000s featured a rapid expansion in the quantity of ETFs offered despite the total number of assets growing much slower and even declining during some years. The growth of ETFs relative to the funds invested in them can be seen in Figure 2. The increased quantity of ETFs was partially due to new entrants into the market such as PowerShares and mutual fund heavyweight Vanguard (Ferri, 2008). This coincided with the emergence of a flood-the-market model (Ferri, 2008). ETF issuers created many ETFs and released them all on the same day and



simply watched which ones attracted the most investments. The flood-the-market model is exemplified perfectly by Barclays Global Investors launching 50 ETFs in 2000, and Rydex filing for almost 100 ETFs in 2006. Both events took place in one day. The growth in the total number of ETFs has remained relatively strong with over 2,200 distinct ETFs trading in the U.S. today.

Part of the reason for the large number of ETFs is the large number of issuers of ETFs. There are over one-hundred issuers that manage ETFs that are currently being traded. The top

ten issuers of ETFs by assets under management are shown in Table 1. Of all the issuers, BlackRock manages the largest number of ETFs (343) and commands the greatest share of the market in terms of assets under management (39%). An extremely large part of the market is dominated by three firms: BlackRock, Vanguard, and State Street Global Advisors. Calculating the Herfindahl-Hirschman Index for the market based on assets under management yields 2,508.95. This is approximately equivalent to a market in which four firms with equal shares dominate the entire market.

Table 1: The top 10 issuers of ETFs by total assets under management as of 3/13/2019. The data used to develop this table was acquired from ETF.com.

Issuer	Assets Under Management ($mm)	ETFs issued	% of Issued ETFs	% of AUM
BlackRock	1,452,691.28	343	15%	39%
Vanguard	934,989.44	80	4%	25%
State Street Global Advisors	609,738.50	140	6%	17%
Invesco	183,936.26	252	11%	5%
Charles Schwab	129,602.38	22	1%	4%
First Trust	68,504.75	141	6%	2%
WisdomTree	38,316.48	85	4%	1%
VanEck	36,070.61	58	3%	1%
ProShares	30,501.76	141	6%	1%
JPMorgan	22,966.37	34	2%	1%

It appears that BlackRock has opted to create an ETF for any strategy that is developed, and then see which strategies are able to attract a sufficient amount of investment to remain viable. This would fall in line with the flood-the-market-model mentioned earlier. It is important to note that issuers cannot patent the idea of tracking a specific index or strategy. Thus, if BlackRock sees an ETF work for another issuer, BlackRock can develop a similar ETF to offer to its customers.

Vanguard is able to command such a large market share with relatively fewer ETFs issued due to its patented structure. Vanguard is able to do this because they are not patenting the tracking of a specific index, rather just the type of fund used to issue the ETF. When Vanguard created their first ETF, known as VIPERs, the ETFs were linked to their already existing open-end funds (Ferri, 2008). This allowed the ETFs to be traded during the day and the fund shares to trade after the market is closed (Ferri, 2008). Additionally, according to their website, Vanguard offers commission free purchase and sale of Vanguard ETF shares if they are bought or sold through their brokerage services. This provides and incentive for individuals that are already invested in Vanguards mutual funds to purchase ETFs from Vanguard rather than other issuers.

State Street is able to maintain some competition with BlackRock and Vanguard due to the popularity of SPDRs. Of the $609 billion of assets invested in State Street ETFs, approximately $272 billion is invested in SPY (the current ticker for SPDRs on the NYSE), which is the largest amount of all ETFs. The next largest ETF, the IVV from BlackRock that also tracks the S&P 500, only manages approximately $174 billion. Furthermore, the next largest State Street ETF only manages approximately $32 billion.

Since there are many firms with the ability to issue ETFs, these firms have sought ways to distinguish themselves from the crowd. In 2008, the SEC began allowing fund issuers to create actively managed ETFs (Investment Company Institute, 2018). Up until 2008, all ETFs tracked an index that was specified when the fund filed with the SEC. Actively managed ETFs are not required to attempt to follow a prespecified index, but they are still subject to some key

regulations. Most notably, actively managed ETFs are required to disclose the component securities and their weight every day.

Despite concerns regarding the practicality of actively managed ETFs, the market for them has continued to grow since 2008. By the end of 2017 the total number of active ETFs reached 194, and they were responsible for managing over $15 billion worth of assets (Investment Company Institute, 2018). However, the majority of the market still consists of passive ETFs that track a variety of assets including bonds and commodities. Some of these passive ETFs have tracked niche markets or specific portfolios to appeal to certain investors. These include socially responsible ETFs that track an index based on an SRI strategy.

Socially Responsible ETFs

SRI is often discussed along with ESG investing, and occasionally used interchangeably. ESG investing considers environmental, social, and governance criteria when choosing investments. Thus, any strategy that takes those criteria into consideration, even if the strategy focuses on investing in companies that partake in practices not considered socially responsible, can be considered ESG investing. The two terms should not be used interchangeably because SRI is subjective, whereas ESG investing is not. Consider a company that manufacturers a birth control pill. A pro-choice individual may consider the company socially responsible, but a pro-life individual may believe the opposite. To distinguish the two; SRI is a type of ESG investing, but ESG investing is not necessarily socially responsible.

After relatively slow growth during the early 2000s, SRI took off after 2010. As of 2010, SRI accounts for about $12 trillion worth of investments in the United States, which is approximately 26 percent of the total amount of assets invested in the United States (US

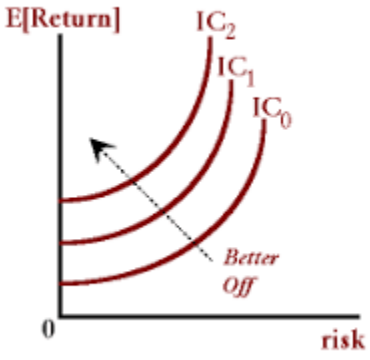
Sustainable Investment Forum, 2018). The total amount of investment in socially responsible ETFs is relatively small compared to total SRI. Most of socially responsible investing is conducted through mutual funds and money managers. Socially responsible ETFs account for a little more than $10 billion in total investment. Although this number is relatively low compared to the total amount of assets under management for all ETFs and the total amount invested based on socially responsible criteria, $10 billion is far from negligible. Additionally, it appears ETF managers view SRI as a growing subset of ETFs since they have created 69 new socially responsible ETFs since 2010, 20 of which were launched in since 2018. More detail regarding the issuers of socially responsible ETFs and the number issued per year can be found in Appendix A.1.

Interestingly, only two socially responsible ETFs are recognized as actively managed by the U.S. Securities and Exchange Commission (SEC). This stems from socially responsible ETFs having an overall investment strategy and a specific index defined, similar to other index ETFs. For example, the gender diversity ETF (ticker SHE) is and index ETF that defines how it chooses which companies are considered gender diverse and specifies the weights for each of the companies based on market cap. The selection of stocks in an SRI ETF is also subjective since there are multiple ways to define the criteria that qualifies a stock to be considered in an ETF. The gender diversity ETF defines a company as gender diverse if their ratio of women on the board of directors and executive positions is in the top 10% of their industry.

Model and Theory

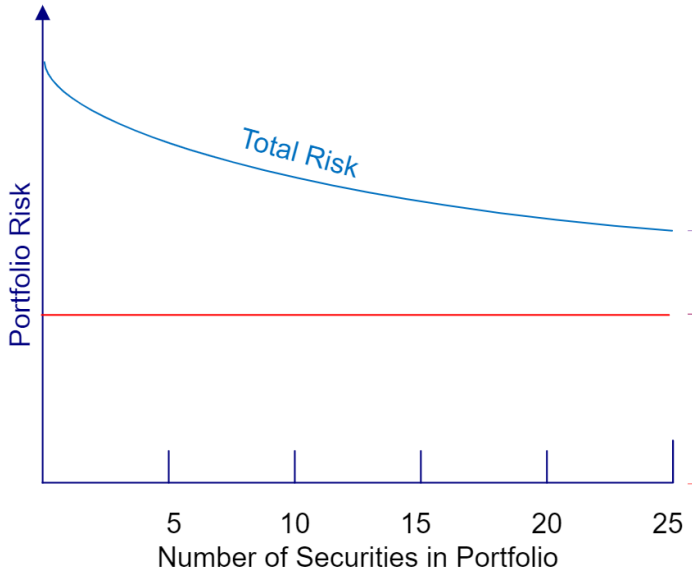
Standard portfolio theory measures utility based on the expected return of the portfolio and the risk associated with the portfolio, typically measured by the standard deviation of the returns. This paper will include SRI as an additional criterion that an investor considers when maximizing utility. The resulting function for utility is shown in equation 1. The partial effect of each of the factors on utility is shown below that equation.

The first two partial effects indicate that an investor will always prefer a higher return, and a risk averse investor prefers less risk. These two assumptions are common in the literature and result in an investor demanding a higher return to invest in a riskier portfolio; otherwise known as a risk premium. The relationship between expected return and risk, and their effect on an investor's utility, can be :e curves; as in Figure 3. Additionally, an investor is exp in a socially responsible portfolio. An investor is then e: wer expected return or higher standard deviation of returns f entioned in Bello (2005). Thus, using Figure 3, an investor may at lies on IC_1 instead of a portfolio on IC_2 if the first portf his will happen if the gain in utility from the SRI is greater than the utility difference between IC_1 and IC_2.



There is also the possibility that investors are targeting SRI funds because they believe they are a superior investment and will yield higher risk-adjusted returns. These investors may still gain some utility from investing in SRI funds because they believe they are doing some good. However, the partial effect of SRI on their utility function could be zero.

Individuals looking to invest in SRI funds must also be aware of the effect of the number of securities in a portfolio on risk. The standard deviation of returns for a portfolio can be attributed to systemic and unsystemic risk. Systemic risk is the risk an investor has due to the standard deviation of performance of the entire market. Unsystemic risk is portfolio specific but is typically smaller for portfolios that include many securities that are not highly correlated. Figure 4 sho s held in the portfolio roaches zero as the n isk since it cannot be re s that meet the specified ıe to a decrease in t



Despite theory predicting possible subpar performance from socially responsible funds and stocks, past empirical research has not supported this prediction. The majority of studies are unable to find a significant difference in the performance of socially responsible funds relative to conventional funds (Hamilton, Jo, & Statman, 1993; Statman, 2000; Revelli & Viviani, 2015). The results have persisted through time as additional stock return data and more advanced methods of analysis have emerged. Climent and Soriano (2011) is a rare study that

finds SRI funds underperformed conventional funds. However, the results were not always significant when examining different time periods.

SRI and Sin Portfolio Performance

The growth in SRI gave rise to an alternative strategy in which funds invest in sin or vice stocks. The major types of sin stocks which are included in most studies are tobacco, alcohol, and gaming (Blitz & Fabozzi, 2017). Some studies include additional subcategories such as adult entertainment, defense, marijuana, or biotech (Blitz & Fabozzi, 2017; Fabozzi, Ma & Oliphant, 2008). Similar to SRI, deciding which industries to consider sin industries is subjective. These funds aim to generate higher returns by investing in stocks that are avoided by socially responsible investors. The higher returns are expected because the stocks are expected to be underpriced due to investors actively avoiding them.

There have been a number of studies that analyze the returns of sin stocks (Blitz & Fabozzi, 2017; Fabozzi, Ma & Oliphant, 2008; Richey, 2016; Richey, 2017). These studies have examined the performance of the VICEX mutual fund and the performance of stocks in specific sin industries. This is typically done using variations the CAPM model including the Fama and French 3-factor model, the Carhart 4-factor model, and the Fama and French 5-factor model. Superior performance of a stock or a mutual fund will be reflected by a positive alpha in these models.

Each of the studies find a positive and significant alpha for the stocks and funds they were testing when using the CAPM and 3-factor model. The alphas occasionally lost their

significance when estimating the Carhart 4-factor models. Furthermore, the alphas were almost never significant when the 5-factor model was estimated. However, even while estimating the 5-factor model, alpha was positive a majority of the time. Alpha was only negative for a select few time periods or industries, and never significant in these cases.

Data and Preliminary Results

The examined data will consist of socially responsible ETFs that have been active for the period 2009-2018. This results in 120 monthly return observations for each ETF. This study calculates the monthly returns of the ETFs by collecting the close price of the ETFs at the end of each month and any dividends paid. This is shown in equation 2. It should be noted that the expense ratios of the ETFs do not need to be separately accounted for in this equation. The expense ratio is taken directly out of the fund, which decrease the underlying NAV of each ETF. The decrease in the NAV will then be reflected in a decrease in the price of the ETF. ETFs are considered SRI in this study if they are included in the socially responsible by ETF.com, which is based on the MSCI ESG fund metrics. Basic descriptive statistics for the ETFs used in the study are shown in Table 2. Additionally, descriptive statistics for the SPY and VTI ETFs are included. SPY and VTI attempt to track the S&P 500 and the total market index, respectively. Thus, they are used to compare the performance of the socially responsible ETFs to the performance of the market. The Sharpe ratio, which will be addressed shortly, is also presented.

Table 2: Basic ETF information and statistics.

ETF Info				Monthly Return Info (%)				
ETF	Date Issued	Issuer	# of Holdings	Mean	Std. Dev.	Min	Max	Sharpe Ratio
SUSA	01/24/05	BlackRock	127	0.94	3.95	-9.89	11.27	0.232
PBW	03/03/05	Invesco	39	-0.13	7.71	-23.56	18.16	-0.020
EVX	10/10/06	VanEck	21	0.81	4.41	-11.46	18.26	0.178
PZD	10/24/06	Invesco	52	0.81	5.64	-15.41	20.16	0.140
DSI	11/14/06	BlackRock	388	1.20	3.96	-9.39	11.39	0.298
QCLN	02/08/07	First Trust	37	0.68	7.25	-19.27	19.78	0.091
GEX	05/03/07	VanEck	30	0.14	7.01	-21.29	23.05	0.016
PBD	06/13/07	Invesco	108	0.19	6.97	-22.07	21.67	0.023
TAN	04/15/08	Invesco	24	-0.30	12.14	-40.84	29.72	-0.027
FAN	06/16/08	First Trust	44	0.33	6.63	-16.43	21.90	0.045
ICLN	06/24/08	BlackRock	30	-0.26	7.85	-29.88	20.29	-0.036
SPY	01/22/93	State Street	489	1.10	3.93	-10.74	10.91	0.275
VTI	05/24/01	Vanguard	3581	1.12	4.05	-10.53	11.37	0.272

The descriptive statistics indicate that the best performing socially responsible ETF was the only ETF able to outperform the market. DSI yielded an average return of 1.2% per month and had the second lowest standard deviation of returns of the socially responsible ETFs. Although SUSA had a lower standard deviation of returns than DSI, they were still higher than SPY. Additionally, the lower standard deviation of returns coincided with a lower average return than both SPY and VTI. The worst performing ETF is TAN. It yielded the lowest average monthly return of -0.3, as well as the highest standard deviation of 12.14. The standard deviation of TAN was considerably higher than the rest of the sample.

Sharpe Ratio

The Sharpe ratio, which is calculated using equation 3, is commonly used in financial analysis because it provides a quick and easy way to judge the performance of securities based on past returns.The Sharpe ratio for each ETF is displayed along with the descriptive statistics in Table 2. In general, the socially responsible ETFs tend to underperform the market in risk-

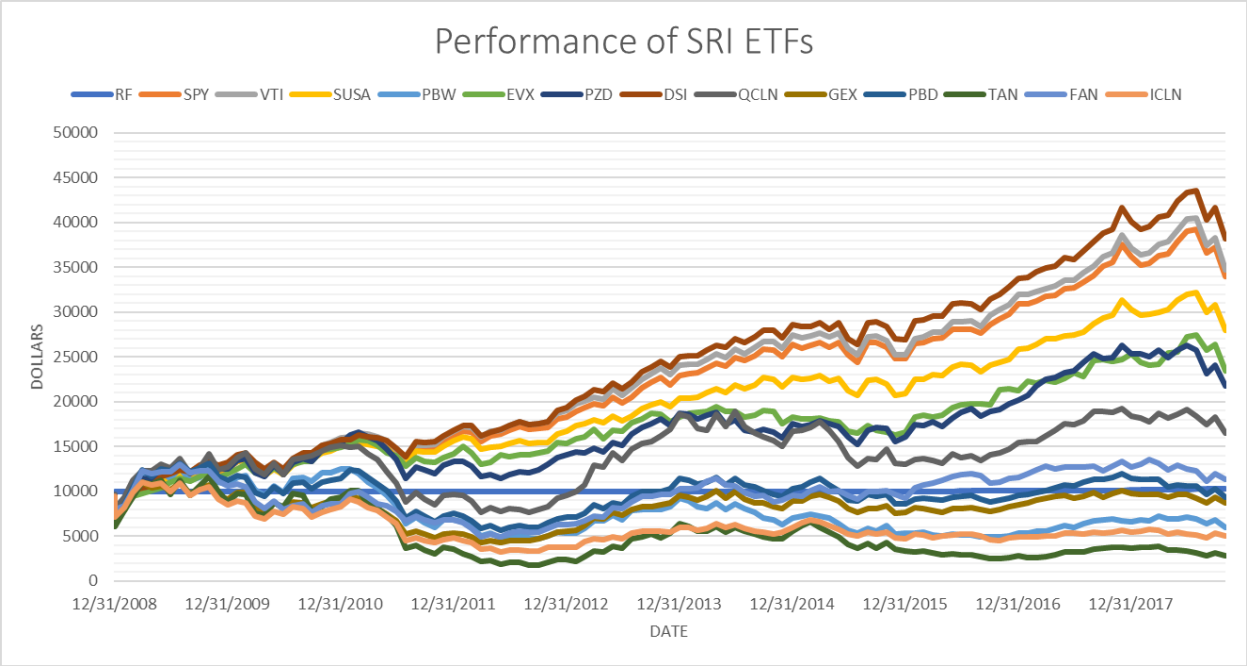
adjusted returns. Of the eleven socially responsible ETFs evaluated, only DSI generated a higher return than SPY or VTI. Furthermore, only two of the socially responsible ETFs, SUSA and DSI, had lower standard deviations than either SPY or VTI. The lower standard deviation of returns from SUSA and DSI relative to the other socially responsible ETFs is likely a result of the number of stocks that comprise the ETF. Notably, neither one of these ETFs focus on energy, but on the entire socially responsible market as a whole.

As previously mentioned DSI is the only ETF that successfully outperformed the ETFs that track the S&P 500 and the CRSP. The difference in the performance between DSI and SUSA, both of which include multiple types of socially responsible stocks, can be attributed to the weighing method of their portfolios. SUSA picks 100 stocks with the highest ESG scores that are assigned by MSCI. SUSA then weighs stocks that earn higher scores more heavily. Contrarily, DSI uses a market-cap-weighted index that allows the best performing stocks to become a larger part of the portfolio. This allows DSI to be successful despite the clean energy industry struggling. However, SUSA earns a higher ESG score from MSCI, 8.09 compared to 6.65 for DSI.

Cumulative Return

Another method of differentiating between the ETFs in this study is examine what would happen to $10,000 invested in each one at the beginning of the sample period and allowed to grow (or decline) until the end of the sample period. The growth (or decline) of each ETF can be seen in Figure 5. On the polar ends of the graph DSI performed the best by returning $38,230.82 on a $10,000 investment, but TAN resulted in only $2,837.87 being left from that investment. The drastic difference is due to the effect of compounding interest. As the interest gained is reinvested it magnifies the total amount gained on the portfolio. For DSI, a 1.2%

increase at the end of the period yields $458.77 compared to only $120 at the beginning of the period.

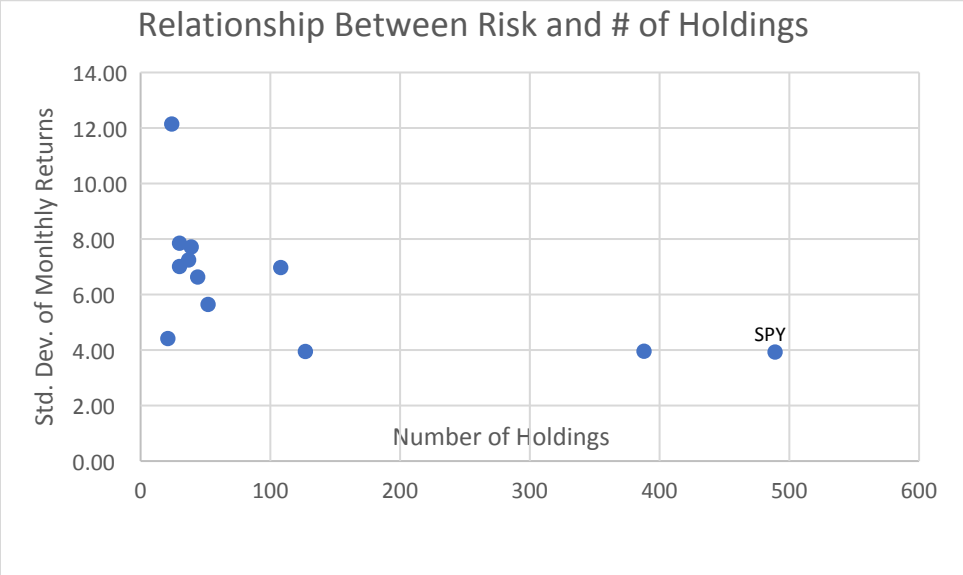


Diversification and Risk

Using the number of holdings and standard deviation of returns, it is possible to view the relationship between diversification and risk (as shown in Figure 4). Figure 6 displays the expected trend that total risk decreases as the number of holdings increase. Clearly, not all ETFs stick to the trend. Despite holding 108 different securities, PBD still shows a relatively high level of risk because all of the securities are in one industry (clean energy). Although most of the ETFs in the study demonstrate higher levels of risk than the market, it appears an investor does not need to take on a large amount of extra risk if they choose a socially responsible ETF carefully. Specifically, one with many holdings that are not highly correlated. Appendix A.2 provides the top ten holdings of each ETF as well as the percent of the funds assets that are invested in top

ten holdings each ETF. It can provide insight into how concentrated an ETF is in an industry by examining the top ten holdings of the ETF.

CAPM and Fama-French Models



The core of this study will use the CAPM, Fama and French 3-factor model, and Carhart 4-factor model to estimate the performance of socially responsible ETFs. These models are commonly used to analyze the performance of stocks and mutual funds since the performance of the portfolio is represented by the constant that is estimated in the equation. This paper has already examined previous studies that have used these models to estimate the performance of investing in portfolios based on ESG criteria. If one would like to further explore the models and factors, Richey (2017) goes into detail for each model and how the factors are calculated. This paper will use Richey (2017) to briefly touch on each of the models and the meaning of each factor.

The most basic of the models, the CAPM model, estimates the performance of the portfolio by controlling for the performance of the market relative to the risk-free rate. The regression equation is then given in equation 4.

In equation (4) α_p represents the risk-adjusted excess return holding beta risk constant. The expected value of α_p is zero for a portfolio that has no excess return. The CAPM model has since been expanded to include additional factors besides the systematic risk in the marketplace. The Fama and French 3-factor model includes additional factors to control for the size of the firm (SMB) and whether the firm's stock is a value stock or a growth stock (HML). Fama and French estimate these factors by using the returns of portfolios consisting of stocks with specific characteristics such as *small value* or *big growth*. The equations used by Fama and French to calculate these factors are shown in equations 5 and 6. Adding these two factors to the CAPM model produces equation 7.

Finally, the Carhart 4-factor model adds on a momentum factor (MOM) to the Fama and French 3-factor model. This is due to the tendency of superior performance from stocks that have

recently performed well relative to stocks that have recently performed poorly. The equation used by Fama and French to calculate the momentum factor is given in equation 8. Similar to SMB and HML, the momentum equation still uses the size of the firm to create portfolios for the equation. Additionally, it considers the past performance of portfolios to differentiate the portfolios with high returns (*Small High* and *Big High*) from the ones with low returns (*Small Low* and *Big Low*). After using the estimate for momentum, the resulting equation for Carhart's 4-factor model is given in equation 9.

All of the data for the factors mentioned is free to use and has been acquired through French's faculty website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french). is calculated using all firms incorporated in the U.S. and listed on the NYSE, NASDAQ, or AMEX. is calculated using the one-month Treasury bill rate.[1] The descriptive statistics of each of these factors are displayed in Table 3. A quick look at the mean of the factors indicate that the small firms outperformed the big firms, value stocks underperformed the growth stocks, and stocks that had positive returns over the previous year did not perform better than stocks with negative returns.

[1] The correlation between (VTI -) and the Fama and French (-) is approximately .999.

	FF Descriptive Statistics			
	Mean	Std. Dev.	Min	Max
Rm-Rf	1.106	4.041	-10.10	11.35
SMB	0.071	2.480	-4.78	6.87
HML	-0.163	2.657	-11.10	8.32
MOM	-0.058	3.761	-24.97	7.40

CAPM Results

A regression of the CAPM model, displayed in Table 4, yields similar results as the Sharpe ratio, but allows for significance testing of excess performance relative to the market. Ten of the eleven socially responsible ETFs produce negative excess returns relative to the market. This result is primarily caused by the poor performance of the clean energy industry in the past decade. Notably, all of the negative results are significant except for EVX, which focuses on environmental services. As expected from the Sharpe ratio, DSI generated positive excess returns relative to the market, and is significant at the 10% level.

*Table 4: Regression results using the CAPM model. Each ETF had 120 observations since monthly returns were used for a full decade. The standard deviations of the estimates are provided in parentheses. * indicates significance at the 95% confidence level.*

	ETF										
Coefficient	SUSA	PBW	EVX	PZD	DSI	QCLN	GEX	PBD	TAN	FAN	ICLN
α	-0.151*	-1.764*	-0.169	-0.618*	0.106	-0.937*	-1.375*	-1.368*	-2.447*	-0.995*	-1.776*
	(0.07)	(0.47)	(0.26)	(0.23)	(0.06)	(0.41)	(0.42)	(0.40)	(0.89)	(0.44)	(0.54)
β	0.962	1.454	0.859	1.268	0.967	1.439	1.343	1.381	1.919	1.170	1.350
	(0.02)	(0.11)	(0.06)	(0.05)	(0.02)	(0.10)	(0.10)	(0.10)	(0.21)	(0.11)	(0.13)
Residual SE	0.73	5.02	2.74	2.39	0.66	4.34	4.46	4.20	9.38	4.67	5.67
R^2	0.967	0.581	0.618	0.823	0.972	0.644	0.599	0.640	0.408	0.508	0.483

Some of negative alphas are alarming due to their size since these are only the monthly returns, not annual. This can be attributed to a combination of poor performance and high-risk of some of the ETFs. For example, since the market (using VTI returns) average monthly returns were 1.12%, that translates to roughly 13.44% per year. TAN has a beta of 1.919 and therefore has high beta risk. Since TAN has a beta of nearly 2, its return would be expected to be nearly double the VTI return.

3-Factor and 4-Factor Results

Similar to the CAPM model, the key coefficient to this analysis is alpha since it measures excess returns. Thus, only the alphas of each model and the corresponding standard error is included in Table 5. The full regression estimates for both the 3-Factor and 4-Factor models are included in the appendix A.3 and A.4.

Interestingly, there are no drastic changes to any of the alphas due to the more

	Alphas of Each Regression										
	ETF										
Model	SUSA	PBW	EVX	PZD	DSI	QCLN	GEX	PBD	TAN	FAN	ICLN
CAPM	-0.151*	-1.764*	-0.169	-0.618*	0.106	-0.937*	-1.375*	-1.368*	-2.447*	-0.995*	-1.776*
	(0.07)	(0.47)	(0.26)	(0.23)	(0.06)	(0.41)	(0.42)	(0.40)	(0.89)	(0.44)	(0.54)
3-Factor	-0.189*	-1.716*	-0.131	-0.619*	0.088	-0.915*	-1.346*	-1.375*	-2.523*	-1.061*	-1.849*
	(0.06)	(0.47)	(0.26)	(0.22)	(0.06)	(0.40)	(0.43)	(0.41)	(0.91)	(0.45)	(0.55)
4-Factor	-0.190*	-1.723*	-0.135	-0.626*	0.088	-0.921*	-1.356*	-1.387*	-2.531*	-1.074*	-1.858*
	(0.06)	(0.46)	(0.26)	(0.21)	(0.06)	(0.40)	(0.42)	(0.39)	(0.91)	(0.43)	(0.54)

specified models. In fact, if there was a change, it often caused alpha to deviate further from zero than before. This is surprising because it is expected that some of the excess returns from the CAPM model would be explained by the additional factors included, similar to the effect seen in the studies of sin stocks. Furthermore, there are absolutely no changes when testing for significance at the 95% confidence level.

The results of the additional models provide further evidence that socially responsible ETFs have provided inferior returns. The inferior returns are due to a number of reasons. The most important reason is likely the failure of the renewable energy industry. One possible explanation for this is that the renewable energy industry was receiving too much hype during the mid-2000s. The considerable amount of attention would encourage asset managers to create ETFs that track parts of the renewable energy industry. Additionally, if there was too much hype surrounding the renewable energy industry, it would have led investors to overestimate the value of the stocks and ETFs.

Correlation Matrix

It is important to analyze a correlation matrix because it is reasonable to expect an individual who invests in one socially responsible ETF to want to invest in another. However, if the returns are highly correlated, the investor may still have a relatively high-risk portfolio.

It is immediately evident from the correlation matrix provided in Table 6 that many of the ETFs in the study are highly correlated. This is likely due to seven out of eleven of the ETFs focusing on some variant of clean energy. Two of the ETFs were slightly less correlated because they invested in multiple avenues of SRI. However, the correlation coefficient between these two ETFs and the other ETFs in the study are still typically above .7. EVX appears to be the least correlated with the other ETFs because it focuses on the service industry rather than energy. Despite this, the lowest correlation coefficient between EVX and any of the other ETFs is still .5 (the lowest among any pair of ETFs in this sample).

Table 6: A correlation matrix of the returns for each ETF included in the study. The ETFs are labeled by the ticker assigned with the ETF.

	SUSA	*PBW*	*EVX*	*PZD*	*DSI*	*QCLN*	*GEX*	*PBD*	*TAN*	*FAN*	*ICLN*
SUSA	1										
PBW	0.725	1									
EVX	0.783	0.623	1								
PZD	0.894	0.850	0.768	1							
DSI	0.985	0.732	0.779	0.892	1						
QCLN	0.773	0.944	0.663	0.866	0.779	1					
GEX	0.757	0.903	0.674	0.898	0.752	0.911	1				
PBD	0.785	0.915	0.663	0.905	0.776	0.899	0.952	1			
TAN	0.610	0.914	0.498	0.750	0.620	0.853	0.858	0.879	1		
FAN	0.714	0.746	0.622	0.821	0.708	0.739	0.879	0.891	0.745	1	
ICLN	0.677	0.870	0.587	0.818	0.677	0.831	0.913	0.914	0.902	0.844	1

ESG and Alpha

The results from the variations of the CAPM model indicate that a majority the socially responsible ETFs clearly underperformed. A further evaluation can be conducted to see if ETFs

with higher ESG scores yielded higher or lower returns relative to the other ETFs in the study. The MSCI ESG ratings rate stocks and portfolios on a scale from 0 to 10 to quantify how socially responsible the stock or portfolio is. It is then possible to use these scores to evaluate performance of socially responsible ETFs based on how socially responsible they are. This can be done using a simple linear regression model, which is shown in equation 10. If the model specified earlier is correct, then the ETFs with higher ESG scores will have lower alphas than the ETFs with lower ESG scores. However, the results are not expected to be statistically significant due to the small sample size. Despite this, the analysis may still provide insight into the why the alphas from the earlier regressions deviated so far from zero.

The ESG scores for each of the 11 ETFs used in the study are presented in Table 7. Additionally, the table displays the estimated effect of ESG score on alpha. The results are not significant, as expected, but the estimated effect of ESG score is positive, which was not expected. One possible reason is that the two ETFs with the most diversified holdings were able to reduce exposure to the renewable energy industry, but they still had relatively high ESG scores. On the opposite end of the spectrum, TAN provided one of the lowest ESG scores in the study with the worst performance in the study. The low ESG score is shocking since TAN holds stocks that are highly invested in solar energy. One possibility is that many of the firms in the solar used poor governance practices. However, it is difficult to examine this without access to the ESG scores of all of the holdings of TAN.[2]

[2] The individual stock ESG scores are proprietary information that must be purchased, which has not been done for this study.

Regardless of the cause of the low ESG score, the results of the regression do not support the hypothesis that investors are paying a premium to invest in ETFs that have higher ESG scores. In fact, the results imply exactly the opposite. It is clear that more research must be conducted in order to develop conclusive results.

Limitations and Future Research

The possibility that the renewable energy industry was overhyped is not provided as evidence to disregard the negative returns as a fluke. Since there is a limited sample, it is important to consider alternative explanations that may have caused the negative alphas. If it was indeed due to an overhyped industry, research can be done on events in which many similar ETFs or mutual funds are opened in a short period of time. Theoretically, the ETFs and mutual funds are being opened in order to take advantage of a public perception of the industry. If the funds regularly show inferior performance, then that may also be the cause of the negative performance of socially responsible ETFs in this study.

		Alpha		
	ESG Score	CAPM	3-Factor	4-Factor
SUSA	8.09	-0.151	-0.189	-0.190
PBW	5.31	-1.764	-1.716	-1.723
EVX	4.3	-0.169	-0.131	-0.135
PZD	6.67	-0.618	-0.619	-0.626
DSI	6.65	0.106	0.088	0.088
QCLN	5.29	-0.937	-0.915	-0.921
GEX	6.03	-1.375	-1.346	-1.356
PBD	6.15	-1.368	-1.375	-1.387
TAN	5.31	-2.447	-2.523	-2.531
FAN	6.88	-0.995	-1.061	-1.074
ICLN	6.34	-1.776	-1.849	-1.858
ESG Score Coefficient		0.244	0.222	0.223
Standard Errors		(0.25)	(0.25)	(0.25)

It may also be prudent to examine the fund flows of the socially responsible ETFs. If the investors are shifting there investments away from the poor performing socially responsible

ETFs to the better performing socially responsible ETFs, that may indicate that they are not willing to pay a high premium to invest socially responsibly. This exercise will be tricky because it will be necessary to compare the fund flows to other ETFs to control for the growth and evolution of the ETF market.

Although it may be frustrating, it may be necessary to wait for better data on socially responsible ETFs. As mentioned earlier in this paper, there are currently 80 socially responsible ETFs being traded on U.S. exchanges. However, many of them could not be used because they have only been on the market for a short period of time. A similar study, which may utilize more advanced econometric methods that have been developed, can be conducted in a few years with more conclusive results.

Conclusion

The birth of ETFs was the result of a desire from investors to purchase small shares that tracked a market index. However, ETFs proved to be a revolutionary idea by allowing investors to make small investments in many different countries, industries, sectors, strategies, and ideals. The variety of ETFs in conjunction with the small requirement to invest in them has provided a unique tool for everyday investors to build a portfolio that maximizes their utility.

This paper has examined the performance of socially responsible ETFs from the perspective of a utility maximizing investor. The results indicate that investing in clean energy or stocks that are considered very socially responsible yield lower returns, and often higher standard deviations. Only investors whose utility functions are dominated by the effect of SRI should consider investing in those type of stocks. An investor that prioritizes a high return and low standard deviation, but still gains some benefit from SRI, can still increase his utility by

investing in a broad index that allows successful stocks to be weighed more heavily. The broad socially responsible indexes also performed better based on MSCI's ESG rating system. Thus, an investor set on investing in socially responsible stocks may be able to gain a situational free lunch by investing in an ETF with a relatively higher return and a higher ESG score.

It should be noted that past studies did find evidence of higher returns for sin stocks. This implies that return focused investors still face a trade-off due to the opportunity cost of not investing in sin stocks. Future studies that examine the performance of a combination of sin ETFs, broad market index ETFs, and socially responsible ETFs will be useful for examining the relationship between socially conscious investing and returns. As data for ETFs aimed at certain preferences become more common, this type of analysis will become more conclusive. This will be vital to provide to investors so that they can properly weigh tradeoffs and construct a portfolio ideal for them.

Appendix

A.1: Issuance of Socially Responsible ETFs

Year	# of SRI ETFs	Issuer	# of SRI ETFs
2005-2013	12	Barclays	2
2014	5	BlackRock	13
2015	3	Change Finance	1
2016	21	Columbia	3
2017	19	Deutsche Bank	3
2018	18	ETF Managers	1
		Exchange Traded Concepts	2
		First Trust	2
		Goldman Sachs	1
		Impact Shares	3
		Invesco	4
		Krane Shares	1
		Legg Mason	2
		Mirae	4
		Montage	1
		Nationwide	2
		Northern Lights	4
		Northern Trust	2
		Nuveen	8
		OppenheimerFunds	2
		Pacer	1
		Point Bridge	1
		Sage	1
		SS&C	1
		State Street	6
		VanEck	3
		Vanguard	2
		WisdomTree	3

A.2: Top Ten Holdings of Socially Responsible ETFs

Top 10 Holdings by ETF

	QCLN	GEX	PBD	TAN	FAN	ICLN
1	ON Semiconductor	AMETEK	Itron	First Solar	Siemens Gamesa Renewa	Ormat Technologies
2	Universal Display	Vestas Wind Systems	Acuity Brands	SolarEdge Techonologies	Orsted	Contact Energy
3	Albemarle	Microchip Techonology	Landis+Gyr Group AG	Xinyi Solar Holdings	Vestas Wind Systems	Meridian Energy
4	Tesla	Eaton	Signify NV	Enphase Energy	Northland Power	SolarEdge Techonlogies
5	Hexcel	Tesla	Cree	Sunrun	China Longyuan Class H	Siemens Gamesa
6	Cree	Cree	Kingspan Group	Canadian Solar	Pattern Energy Goup	First Solar
7	First Solar	NIBE Industrier AB Class B	Universal Display	Hannon Armstrong	Renewables Infrastructur	Vestas Wind Systems
8	Acuity Brands	First Solar	Hannon Armstrong	SunPower	Boralex Class A	VERBUND AG Class A
9	Brookfield Renewable Pa	Siemens Gamesa Renewa	NIBE Industrier AB Class B	TerraForm Power	Nordex	China Everbright Inter
10	Littlefuse	VERBUND AG Class A	SolarEdge Technologies	JinkoSolar Holding	Siemens AG	Companhia Energetica
%	54.83%	66.69%	18.94%	61.11%	54.53%	50.19%

Top

		VTI		PBW		PZD
1	osoft	Micr	soft	Enph	e Connections	Autodesk
2	e	Appl		Solar	blic Services	Eurofins Scie
3	zon	Ama		SunP	S	Kingspan Gro
4	book Class A	Face	ture Plc Class A	First S	e Management	Johnson Cont
5	shire Hathaway Class B	Berk	bet Class A	Veec	nced Disposal Servic	Roper Techn
6	son & Johnson	John	ompany	Orme	Tech	Siemens Gam
7	JPMorgan Chase & Co.	Alphabet Class A	BlackRock	Itron	ABM Industries Incorpora	Intertek Grou
8	Alphabet Class C	Alphabet Class C	Northern Trust Corp.	Daqo New Energy	Casella Waste Systems	ANSYS
9	Alphabet Class A	Exxon Mobil	Salesforce.com	JinkoSolar	Donaldson Company	Schneider Ele
10	Exxon Mobil	JPMorgan Chase & Co.	PepsiCo	Hexcel	Covanta Holding	Sensata Tech
%	22.00%	17.44%	29.17%	34.17%	65.64%	

A.3: Fama and French 3-Factor Model Results

	ETF										
Coefficient	SUSA	PBW	EVX	PZD	DSI	QCLN	GEX	PBD	TAN	FAN	ICLN
α	-0.189*	-1.716*	-0.131	-0.619*	0.088	-0.915*	-1.346*	-1.375*	-2.523*	-1.061*	-1.849*
	(0.06)	(0.47)	(0.26)	(0.22)	(0.06)	(0.40)	(0.43)	(0.41)	(0.91)	(0.45)	(0.55)
β	0.998	1.342	0.834	1.227	0.987	1.357	1.309	1.367	1.936	1.242	1.398
	(0.02)	(0.12)	(0.07)	(0.06)	(0.02)	(0.11)	(0.12)	(0.11)	(0.24)	(0.12)	(0.15)
γ (SMB)	-0.111	0.630	0.035	0.302	-0.075	0.508	0.137	0.132	0.178	-0.260	-0.061
	(0.03)	(0.20)	(0.11)	(0.09)	(0.03)	(0.17)	(0.18)	(0.17)	(0.39)	(0.19)	(0.23)
δ (HML)	-0.037	-0.195	0.073	-0.153	-0.006	-0.200	0.001	-0.084	-0.274	-0.032	-0.147
	(0.03)	(0.18)	(0.10)	(0.09)	(0.02)	(0.16)	(0.17)	(0.16)	(0.35)	(0.17)	(0.21)
Residual SE	0.67	4.85	2.76	2.29	0.65	4.21	4.48	4.22	9.43	4.67	5.70
R^2	0.972	0.615	0.620	0.840	0.974	0.670	0.601	0.643	0.412	0.517	0.486

A.4: Carhart 4-Factor Model Results

	ETF										
Coefficient	SUSA	PBW	EVX	PZD	DSI	QCLN	GEX	PBD	TAN	FAN	ICLN
α	-0.190*	-1.723*	-0.135	-0.626*	0.088	-0.921*	-1.356*	-1.387*	-2.531*	-1.074*	-1.858*
	(0.06)	(0.46)	(0.26)	(0.21)	(0.06)	(0.40)	(0.42)	(0.39)	(0.91)	(0.43)	(0.54)
β	0.993	1.320	0.824	1.206	0.985	1.341	1.282	1.331	1.911	1.203	1.369
	(0.02)	(0.12)	(0.07)	(0.06)	(0.02)	(0.11)	(0.11)	(0.10)	(0.24)	(0.12)	(0.15)
γ (SMB)	-0.110	0.635	0.038	0.307	-0.074	0.512	0.144	0.140	0.184	-0.250	-0.054
	(0.03)	(0.20)	(0.11)	(0.09)	(0.03)	(0.17)	(0.18)	(0.17)	(0.39)	(0.18)	(0.23)
δ (HML)	-0.064	-0.309	0.022	-0.262	-0.014	-0.284	-0.139	-0.271	-0.406	-0.233	-0.296
	(0.03)	(0.19)	(0.11)	(0.09)	(0.03)	(0.17)	(0.17)	(0.16)	(0.37)	(0.18)	(0.22)
μ (MOM)	-0.050	-0.216	-0.099	-0.208	-0.015	-0.161	-0.268	-0.356	-0.252	-0.383	-0.285
	(0.02)	(0.13)	(0.07)	(0.06)	(0.02)	(0.11)	(0.12)	(0.11)	(0.25)	(0.12)	(0.15)
Residual SE	0.65	4.81	2.75	2.18	0.65	4.20	4.41	4.06	9.43	4.50	5.64
R^2	0.973	0.625	0.626	0.856	0.974	0.676	0.618	0.673	0.417	0.556	0.501

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