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Who Knocks on the Door of Portfolio Performance Heaven: Sinner or Saint Investors?

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Abstract: To sin, or not to sin: that has been the question for many people for a long time, and nowadays that question has moved to the financial markets. The existence of studies that show that investing in vice sectors such as the alcohol, tobacco, and gambling industries, collectively known as the "triumvirate of Sin", is profitable has created some uncertainty for investors who wonder whether or not to be socially responsible. We show that by implementing an investment strategy based on the Fama–French five-factor model, "saint" investors obtain better portfolio performance, even when transaction costs are taken into consideration, and therefore they are the ones chosen to knock on the door of portfolio performance heaven.

Keywords: socially responsible investments; vice investments; Fama–French five-factor model

1. Introduction

In the early 1960s, Socially Responsible Investment (hereafter SRI) was based on negative criteria that excluded "sin" assets from portfolios, i.e., those related to alcohol, tobacco and the gambling industry, among others, see [1,2]. However, since the 1990s, this type of investment has evolved towards the use of positive selection criteria. Thus, investors began to consider the good practices of listed companies and invest in companies commonly referred to as "best in class", see [3–6].

It was not until the beginning of the 21st century that the term became popular with the launch of the United Nations Principles for Responsible Investment. Today, SRI consists of incorporating financial aspects such as return, risk and liquidity, as well as other aspects related to the company's good environmental, social or corporate governance (ESG) practices, into the asset selection process. In this way, other more specific concepts are covered such as the so-called green investment that only considers the environmental objectives of sustainable investors, see [7–9], or impact investment that considers social aspects, see [10].

Notwithstanding all this, we agree with Betti et al. [11], Cunha et al. [12] and Talan and Sharma [13] in considering that currently this type of investment must progress in the direction of a sustainable investing aligned with the efforts defined by the UN to achieve global sustainable development and concretised in the Sustainable Development Goals (SDGs) and the 2030 Agenda.

On the other hand, the existence of studies that show that investing in the alcohol, tobacco, and gambling economic sectors, collectively known as the "triumvirate of sin", is profitable has created some uncertainty among investors. Salaber [14] found that sin stocks earned excess returns relative to the market as did Fabozzi et al. [15], who examined a sample of sin stocks across 21 countries, finding that they outperformed the market in terms of both magnitude and frequency, and Hong and Kacperczyk [16] showed that sin stock companies significantly outperformed similar comparable stocks.

However, more recently Richey [17] found that investors should not construct a portfolio of sin stocks with the hope of achieving abnormal returns, and Blitz and Fabozzi [18], who employed a

similar procedure, found no premium investment opportunities after controlling for the five factors proposed by Fama and French [19].

Therefore, there is a question blowing in the wind: is it more profitable to be a socially responsible (saint) investor or a vice (sinner) investor? In this paper, we will assume the role of *advocatus diaboli* to look for an answer.

Previous empirical evidence has focused on analyzing the performance of different socially responsible and sin stocks or portfolios on the basis of different ratios, or the Fama–French [20] model and its extensions, in which the research is concentrated on the significance of alpha and beta. However, there is no empirical evidence on developing different strategies based on the value of alphas obtained from the estimation of a Fama–French model for these economic sectors. More precisely, we estimated several portfolios using a spanning procedure based on considering a set of initial assets and analyzing whether the inclusion of additional assets shifted its performance.

Additionally, we will improve on previous empirical evidence by employing exchange traded funds, hereinafter ETFs. These are a portfolio of assets, similar to mutual funds, but are also easily traded like stocks.

Our results showed that investing in responsible ETFs following a positive alpha clearly outperformed the option of investing in vice ETFs following the same strategy, but also other strategies, procedures, and even considering transaction costs. Consequently, following our results, investors should be saints instead of sinners.

The rest of the paper is organized as follows. In Section 2, we present a literature review of the topic, we describe the methodology employed to construct alternative strategies, and the database is defined. Section 3 details the empirical results of the proposed investment strategies. Section 4 provides the results of the robustness test. Finally, Section 5 provides the main conclusions.

2. Materials and Methods

2.1. Literature

Several performance studies have been developed on empirical literature using different asset pricing models such as the Fama–French [20] three-factor model, the Carhart [21] four-factor model, and the Fama–French [19] five-factor model with mixed results. Derwall et al. [22], Statman and Glushkov [23], and Chow et al. [24], among others, found that investing in SRI stocks generated positive abnormal returns. On the other hand, Brammer et al. [25], Derwall and Verwijmeren [26], and Becchetti and Ciciretti [27] provided evidence that SRI stocks generate negative abnormal returns.

There are also numerous studies in which portfolio performance is compared with conventional or similar portfolios. Bauer et al. [28] performed rolling regressions to test for the stability of some asset pricing models. They deduced that ethical funds do not outperform conventional funds. Mateus et al. [29] followed the methodology proposed by Angelidis et al. [30] and reveal that both the Fama-French three-factor and the Carhart four-factor models amplify the underperformance of UK equity mutual funds. More recently, Nofsinger and Varma [31] find evidence that US SRI mutual funds outperform conventional funds during periods of market crises, and underperform them during non-crisis periods. Leite and Cortez [32] investigate the performance of French SRI funds, and show, in accordance with Nofsinger and Varma [31], that they significantly underperform compared to conventional funds during non-crisis periods. However, these French SRI funds only match them during market downturns. Auer and Schuhmacher [33] analyse the performance of socially (ir) responsible investment in the Asian-Pacific region, the United States and Europe. They find that active selection of high- or low-rated stocks does not provide superior risk-adjusted performance in comparison to passive investments. Finally, Silva and Cortez [7] focus on green funds that are certified with an SRI label (SRI funds that use environmental criteria in their investment decisions), finding that they tend to underperform the benchmark investments.

In relation to investments that SRI investors avoid, Salaber [14] found that a European sin stock portfolio outperformed a sin-free portfolio over the period 1975–2006 by more than 4%. Hong and Kacperczyk [16] found that sin stocks earned positive abnormal returns of about 4.5%. These results were corroborated by [34] and [35]. Durand et al. [36] found evidence that there was a positive risk-adjusted performance for sinner stocks, but they did not find a negative risk-adjusted performance for saint stocks. More recently, Richey [37] showed that vice portfolios outperformed the market portfolio on a risk adjusted basis and provided investors with an alternative to simple passive strategies.

However, as mentioned previously, most of the aforementioned empirical evidence was focused mainly on analyzing the performance of asset pricing models or simple portfolios of assets, but there have been other lines of study. Kempf and Osthoff [38], Ziegler et al. [39], Brzeszczyński and McIntosh [40], and Berkman and Yang [41], among others, create portfolios of assets that go long or short following different criteria. In all cases, they tested the significance of the portfolio returns over different asset pricing models but they obtain dissimilar returns. Following this approach to developing an investment strategy, we adhere to the line of Sarwar et al. [42]. They proposed the use of the Fama-French five-factor model for developing an investment strategy. They also propose the use of various rebalancing periods for the portfolios, which lead to finding profitable strategies.

2.2. Methodological Approach

The seminal works of Sharpe [43] and Lintner [44] propose the CAPM model where investors are only compensated for undiversifiable risk. In this model, alpha and beta coefficients are obtained from regressions of stock returns on market returns.

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it} \quad (1)$$

where R_{it} is the asset return for period t; R_f is the risk-free rate; R_{mt} is the return of the value weighted market index for period t; α_i is Jensen's alpha (see [45]); β_i is the systematic risk of the asset; and ε_{it} is the error term.

Fama and French [20] expand the CAPM model and add two additional factors which are the SMB size factor (Small Minus Big returns) and the HML value factor (High Minus Low returns).

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \varepsilon_{it} \quad (2)$$

This model was extended by Carhart [21], who included a momentum factor, MOM, which is estimated as the difference between portfolio returns comprising the stocks of winners and losers in the past.

Finally, Fama and French [19] took into account empirical evidence that suggested that their three-factor model may be incomplete as it fails to capture diverse variations of returns related to profitability and investment (see [46,47]), and proposed a five-factor model in which the differences between stocks with robust and weak profitability (RMW) and the stocks of low and high investment firms (Conservative Minus Aggressive, CMA) were included.

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \varepsilon_{it} \quad (3)$$

Our methodology is not based on expected returns but on the alphas of these models. More precisely, we focus on the alphas of the Fama-French five-factor model. This alpha is known as Jensen's alpha and indicates a superior (inferior) performance of the asset in relation to the benchmark when it is statistically significant positive (negative).

We estimated five-year rolling alphas following the procedure of different authors (see [48–53]), but also that of Morningstar, a leading provider of investment analysis to the mutual fund industry, which uses a default period of 60 months (five years) to estimate most of its performance measures. Afterward, we use those alphas to compose a long-only strategy and a long-only with risk-free asset

strategy on daily data but rebalanced monthly. That means that once the alphas of the ETFs, which compound one portfolio, are considered, they remain unchanged until the end of the month where new alphas are estimated. The following portfolio has the same values as the previous one to the moment in which the first alpha of the new ETF is estimated (which is five years after its inception date). Once again, that alpha remains the same until the end of that month where new alphas for all the ETFs that make up the portfolio are estimated and then considered. Therefore, a total of 25 portfolios are formed for each strategy following a spanning procedure that is based on considering a set of initial assets (six ETFs in our case) for the first portfolio and analyzing whether the inclusion of additional assets, to a maximum of 30 assets compounding our last portfolio, shifts its performance.

A buy signal appears for an asset in month t + 1 in the long-only strategy when the alpha for the rolling window ending in month t is positive, but takes no position when the alpha is negative. On the other hand, the long-only with risk-free strategy considers the investment on risk-free assets (one-month U.S. T-Bill) when the alpha is negative.

There were two main reasons that led us to opt for this procedure. First, the different inception dates for each ETF did not allow us to compose a portfolio of several assets that covered a long-run performance and varying market conditions. For that reason, we decided to analyze an initial portfolio of six assets, which formed the basis of those formed by seven, eight, and so on until thirty ETFs were added to each previous portfolio in their respective inception dates. This procedure allowed us to analyze the benefits of diversification over a long sample with bull and bear phases and also to consider different assets with their different returns and risks. Second, this is a common procedure that was first documented by Huberman and Kandel [54], but has also been employed using different assets by [55–58], among others.

The performances of the proposed portfolios and strategies were evaluated following three methods. The first is called "style-comparison" and was proposed by Sharpe [59], Christopherson [60], and Reilly and Norton [61]. This compares the returns of portfolios that have a similar investment style. Following this method, we considered that portfolios that provided higher cumulated returns were those with better performance.

The second method involves performance measures being "risk-adjusted" to take account of different risk levels. In this case, the Sharpe and Sortino ratios are the most notable, and, once again, higher values are better.

The Sharpe ratio can be defined as the sample mean of excess returns on the risk-free asset, divided by their sample standard deviation. For the risk-free rate, we used the yield of a one-month U.S. T-Bill.

$$\text{Sharpe} = \frac{\hat{\mu} - r_f}{\hat{\sigma}} \tag{4}$$

The Sortino ratio (see [62,63]) is very similar to the former, but instead of dividing the excess return by the standard sample deviation, it is divided by the downside deviation, which only considers excess returns below zero.

$$\text{Sortino} = \frac{\hat{\mu} - r_f}{\text{Downside deviation}} \tag{5}$$

These are the common ratios for analyzing the performance of different portfolios in the empirical evidence, however, it must be pointed out that financial series commonly have asymmetry and kurtosis levels that differ from those found in normal distributions. Given that the Sharpe and Sortino ratios neglect the skewness and kurtosis, they conceal a considerable amount of risk. For that reason, Shadwick and Keating [64] proposed the use of the Omega ratio as a performance measure. The Omega ratio, which is also known as a gain–loss ratio, is the ratio of the cumulative probabilities above and below a specified threshold (zero and risk-free rate in our case), and is defined as follows:

$$\text{Omega} = \frac{\frac{1}{T}\sum_{t=1}^{T} \max\left(0, +R_{p,t}\right)}{\frac{1}{T}\sum_{t=1}^{T} \max\left(0, -R_{p,t}\right)} \quad (6)$$

The main advantage of the Omega ratio is that it makes no assumptions about the underlying distribution of returns.

We evaluate the performance of the proposed strategies by comparing their results with those obtained from an equally weighted (naïve) portfolio. We use it as a benchmark because, as pointed out by DeMiguel et al. [65], this strategy is easy to implement and that is why investors continue to use it in the allocation of their assets.

2.3. Data

In our study, we employed daily returns from 12 February 2001 to 31 July 2019 (amounting to 4644 usable observations) of sixty ETFs: thirty of them representative of socially responsible investments, while the other thirty are representative of vice investments. There is no common procedure in the empirical literature about the number of assets that make up a portfolio. We considered a total of thirty assets because by combining them in different groups, we were able to obtain well-diversified portfolios, so we reduced the risk inherent to a few investments and we increased the possibility of making profits.

Three criteria were followed for selecting the ETFs: the score in the sustainable impact solutions ratio (SIS) as reported by the ETF database (see http://etfdb.com accessed in September 2019), which is considered by the experts as the best website for screening, researching, and analyzing ETFs; the involvement of alcohol, tobacco, and gambling activities that determine the inclusion or not of an ETF on the SRI or vice sectors; and the inception dates.

Tables 1 and 2 show the responsible ETFs and the vice ones, respectively. The first two columns show the code of each ETF and the complete name, respectively, while the third one exposes the inception date. The values of the sustainable impact solution ratios are displayed in the fourth column and, finally, the last three columns exhibit the involvement of the alcohol, tobacco, and gambling sectors of each ETF.

The first criterion is defined by the ETF Database as the exposure of an ETF to Sustainable Impact Solutions which is the portfolio weighted average of each company's percentage of revenue generated by Sustainable Impact Solution goods and services. Accordingly with this definition, responsible ETFs are those with high Sustainable Impact Solution values while vice ETFs are those with the lower ones.

The second criterion is the involvement of each ETF in the alcohol, tobacco, and gambling sectors, which are referred to as the "triumvirate of sin". Those ETFs with high involvement in these sectors as reported by ETF database are associated with non-responsible or vice ETFs, while those without involvement or minimum are considered the responsible ones.

Finally, ETFs were picked with different inception dates due to the impossibility of finding a significant number of ETFs that jointly complied with the previous criteria, but also with the long samples. No ETFs with an inception date beyond the end of July 2013 were chosen because we considered that a minimum of one year of rolling alphas must be used after applying a five-year rolling window for estimating those alphas.

All the ETFs in Tables 1 and 2 are mentioned in descending order of their inception dates because those dates determine the composition of the portfolios. As an example, the first portfolio that will be later referred to as P6, was formed by the first six ETFs of each group, that is, XLV, BBH, PPH, IYH, ICF, and IBB in the case of the socially responsible ETFs. The following portfolio, P7, which added VHT ETF, was the same as the previous one to five years after (the rolling window) the inception date of VHT where that ETF was added to the portfolio due to the appearance of the new rolling alpha.

Table 1. Profile of socially responsible exchange traded funds (ETFs).

Code	ETF Name	Inception	SIS	Alcohol	Tobacco	Gambling
XLV	Health Care Select Sector SPDR Fund	16/12/98	16.32	2.04	0.00	0.00
BBH	VanEck Vectors Biotech ETF	23/11/99	39.22	0.00	0.00	0.00
PPH	VanEck Vectors Pharmaceutical ETF	01/02/00	12.85	0.00	0.00	0.00
IYH	iShares U.S. Healthcare ETF	12/06/00	17.00	1.89	0.00	0.00
ICF	iShares Cohen & Steers REIT ETF	29/01/01	15.89	3.31	2.35	0.00
IBB	iShares Nasdaq Biotechnology ETF	12/02/01	36.43	0.00	0.00	0.00
VHT	Vanguard Healthcare ETF	30/01/04	16.24	1.71	0.00	0.00
PBW	Invesco WilderHill Clean Energy ETF	03/03/05	38.55	0.00	0.00	0.00
PJP	Invesco Dynamic Pharmaceuticals ETF	23/06/05	39.10	0.00	0.00	0.00
PBE	Invesco Dynamic Biotechnology & Genome ETF	23/06/05	20.77	0.00	0.00	0.00
PHO	Invesco Water Resources ETF	06/12/05	15.33	0.00	0.00	0.00
XBI	SPDR S&P Biotech ETF	06/02/06	19.06	0.00	0.00	0.00
IHI	iShares U.S. Medical Devices ETF	05/05/06	21.11	0.00	0.00	0.00
XPH	SPDR S&P Pharmaceuticals ETF	19/06/06	12.02	0.00	0.00	0.00
FBT	First Trust Amex Biotechnology Index	23/06/06	26.53	0.00	0.00	0.00
PTH	Invesco DWA Healthcare Momentum ETF	12/10/06	12.82	0.00	0.00	0.00
PZD	Invesco Cleantech™ ETF	24/10/06	27.29	4.36	0.00	0.00
RYH	Invesco S&P 500® Equal Weight Health Care ETF	07/11/06	14.79	1.56	0.00	0.00
RXL	ProShares Ultra Health Care	30/01/07	13.92	1.54	0.00	0.00
QCLN	Clean Edge Green Energy Index Fund	14/02/07	42.52	2.57	0.00	0.00
FXH	First Trust Health Care AlphaDEX Fund	08/05/07	13.95	0.00	0.00	0.00
PIO	Invesco Global Water ETF	13/06/07	18.41	2.82	0.00	0.00
PBD	Invesco Global Clean Energy ETF	13/06/07	41.03	1.94	0.00	0.00
IFEU	iShares Europe Developed Real Estate ETF	12/11/07	26.78	4.33	0.00	0.00
TAN	Invesco Solar ETF	15/04/08	62.06	0.00	0.00	0.00
ICLN	iShares Global Clean Energy ETF	24/06/08	71.69	0.00	0.00	0.00
PSCH	Invesco S&P SmallCap Health Care ETF	07/04/10	17.79	0.00	0.00	0.00
BIB	ProShares Ultra Nasdaq Biotechnology	09/04/10	30.32	0.00	0.00	0.00
LIT	Global X Lithium ETF	22/07/10	15.95	0.00	0.00	0.00
XHE	SPDR S&P Health Care Equipment ETF	26/01/11	22.09	0.00	0.00	0.00

This table displays some profile data of each ETF. The first three columns report the code, name, and inception date of each ETF. The fourth column (SIS) refers to sustainable impact solutions where a higher number is better. Finally, alcohol, tobacco, and gambling columns show the involvement of each ETF on these economic sectors. Values of these four columns are in percentage.

As was pointed out previously, this procedure was repeated by adding one ETF in each inception date plus five years until the last portfolio was formed, P30. It must be pointed out that although there were inception dates previous to 12 February 2001, it was the chosen date for beginning our sample because it is the inception date of the sixth ETF considered in the socially responsible group and we wanted to use the same sample for both groups.

Interesting data is evident in Tables 1 and 2 regarding the profiles of the selected ETFs, reflecting their differences. First, there were significant dissimilarities in the sustainable impact solution values, where higher values are better. As expected, the values of this ratio were better for socially responsible ETFs, as the sustainable impact percentage was higher (a maximum of 71.69% for the ICLN ETF, whilst the highest value for the vice ETFs was 7.54%, for EWH ETF).

Involvement in the "triumvirate of sin", investing in the alcohol, tobacco, and gambling sectors, was also quite different because there were some socially responsible ETFs with a minimum percentage of involvement in alcohol and tobacco. On the other hand, as expected, all of the socially irresponsible ETFs had a high level of involvement in at least two of the "sin sectors".

Tables 3 and 4 report the main descriptive statistics and stochastic properties of the ETF returns (data are available as Supplementary Materials). On average, socially responsible ETFs had higher returns and lower volatilities than vice ones. On the basis of the ANOVA test, we did not reject the null hypothesis that all the return series for each group of ETFs had the same mean, because the differences were not statistically significant. Moreover, the rejection of the null hypothesis of the equality of variances would lead us to conclude that the differences were statistically significant. Skewness was mostly negative and kurtosis was higher than three in both groups, therefore the distributions of

returns for all the ETFs were mainly negatively skewed and leptokurtic. Finally, the Jarque–Bera statistic rejects the null hypothesis that the returns are normally distributed in all cases.

Table 2. Profile of vice ETFs.

Code	ETF Name	Inception	SIS	Alcohol	Tobacco	Gambling
EWH	iShares MSCI Hong Kong ETF	12/03/96	7.54	34.80	28.48	13.05
EWW	iShares MSCI Mexico ETF	12/03/96	5.23	33.18	28.43	2.50
XLE	Energy Select Sector SPDR Fund	16/12/98	0.11	3.16	25.62	0.00
XLY	Consumer Discretionary Select Sector SPDR Fund	16/12/98	0.49	50.39	9.25	7.34
IYZ	iShares U.S. Telecommunications ETF	22/05/00	3.03	0.00	0.00	52.37
IYE	iShares U.S. Energy ETF	12/06/00	0.53	2.75	26.83	0.00
IYC	iShares US Consumer Services ETF	28/06/00	0.46	58.49	30.04	10.54
RTH	VanEck Vectors Retail ETF	17/05/01	0.16	58.22	28.78	0.00
IGN	iShares North American Tech-Multimedia ETF	10/07/01	3.21	0.00	0.00	18.32
ADRA	Invesco BLDRS Asia 50 ADR Index Fund	13/11/02	4.00	28.33	16.78	18.13
ADRE	Invesco BLDRS Emerging Markets 50 ADR Index F.	13/11/02	2.76	31.11	25.64	18.14
VCR	Vanguard Consumer Discretionary ETF	30/01/04	1.72	46.24	8.46	7.25
VDE	Vanguard Energy ETF	23/09/04	0.20	2.94	25.77	11.00
PEJ	Invesco Dynamic Leisure and Entertainment ETF	23/06/05	1.77	61.48	12.81	10.50
PXQ	Invesco Dynamic Networking ETF	23/06/05	5.03	0.00	0.00	15.18
PMR	Invesco Dynamic Retail ETF	26/10/05	1.94	32.63	19.99	0.00
EEB	Invesco BRIC ETF	21/09/06	1.93	26.96	20.08	10.89
RXI	iShares Global Consumer Discretionary ETF	21/09/06	1.57	47.67	10.95	6.86
RCD	Invesco S&P 500 Equal Weight Consumer	07/11/06	1.57	31.79	14.38	14.46
DIG	ProShares Ultra Oil & Gas	30/01/07	0.46	2.41	23.49	0.00
UCC	ProShares Ultra Consumer Services	30/01/07	0.29	48.00	20.39	7.61
CUT	Invesco MSCI Global Timber ETF	09/11/07	5.67	2.59	33.79	0.00
BJK	VanEck Vectors Gaming ETF	22/01/08	0.00	73.63	63.94	95.15
LTL	Ultra Telecommunications ProShares	25/03/08	2.62	0.00	0.00	45.38
WOOD	iShares Global Timber & Forestry ETF	24/06/08	1.77	3.84	22.23	0.00
CQQQ	Invesco China Technology ETF	08/12/09	1.86	9.07	9.07	14.31
EPHE	iShares MSCI Philippines ETF	28/09/10	3.94	54.74	19.44	3.00
XTL	SPDR S&P Telecom ETF	26/01/11	1.55	0.00	0.00	13.67
MCHI	iShares MSCI China ETF	29/03/11	5.92	26.92	18.15	13.81
FCAN	First Trust Canada AlphaDEX Fund	14/02/12	1.14	28.00	27.17	2.72

This table displays some of the profile data of each ETF. The first three columns report the code, name, and inception date of each ETF. The fourth column (SIS) refers to sustainable impact solutions where a higher number is better. Finally, alcohol, tobacco, and gambling columns show the involvement of each ETF on these economic sectors. Values of these four columns are in percentage.

Table 3. Descriptive statistics social responsible ETFs.

	Mean	Std. Dev.	Skewness	Kurtosis	JB	Obs
XLV	0.000243	0.010769	−0.337087	11.44589	13890.88	4644
BBH	0.000193	0.018700	−10.06546	362.0765	25027519	4644
PPH	1.51×10^{-5}	0.011093	−0.296015	8.848721	6686.981	4644
IYH	0.000227	0.010742	−0.279820	8.451140	5810.443	4644
ICF	0.000232	0.018763	−0.483300	24.60197	90476.66	4644
IBB	0.000241	0.016805	−0.202504	5.633306	1373.527	4644
VHT	0.000316	0.010286	−0.215149	11.24611	11082.66	3901
PBW	−0.000260	0.020340	−0.391718	8.780878	5143.134	3627
PBE	0.000360	0.015960	−0.159395	6.156735	1488.599	3549
PJP	0.000381	0.012054	−0.433064	7.872725	3621.995	3549
PHO	0.000245	0.015139	−0.319861	11.58502	10604.16	3434
XBI	0.000487	0.018292	−0.107908	5.473139	871.2932	3393
IHI	0.000481	0.012015	−0.457598	9.418236	5833.600	3331
XPH	0.000270	0.013705	−0.481629	7.213144	2566.731	3298
FBT	0.000584	0.016628	0.029100	6.912779	2103.654	3297
PTH	0.000396	0.014243	−0.539712	7.151935	2469.166	3220
PZD	0.000183	0.016297	−0.748769	14.19812	17082.55	3212
RYH	0.000432	0.010969	−0.372890	10.30029	7184.535	3202
RXL	0.000556	0.021436	−0.469003	9.692829	5985.173	3145
QCLN	3.47×10^{-5}	0.020381	−0.473897	8.987171	4801.286	3136

Table 3. *Cont.*

	Mean	Std. Dev.	Skewness	Kurtosis	JB	Obs
FXH	0.000441	0.011777	−0.995421	10.45545	7634.444	3077
PBD	−0.000229	0.018504	−0.630487	12.67534	12114.48	3054
PIO	3.98×10^{-5}	0.014637	−0.163054	16.15934	22049.17	3054
IFEU	-9.84×10^{-5}	0.020059	1.475350	145.3556	2464113.	2917
TAN	−0.000765	0.028796	−0.355714	9.968105	5811.639	2843
ICLN	−0.000570	0.021205	−0.617131	15.30037	17784.73	2793
PSCH	0.000659	0.012447	−0.356026	5.393754	609.4141	2345
BIB	0.000796	0.030183	−0.442352	5.689770	782.7146	2343
LIT	-9.62×10^{-5}	0.014404	−0.404448	7.335040	1839.351	2270
XHE	0.000559	0.011206	−0.666113	6.895321	1511.228	2140
Equality	**Mean**	1.271125	(0.1498)	**SD**	245.8162	(0.0000)

This table contains the descriptive statistics for the daily return series for the socially responsible ETFs for the sample period from 5 February 2001 through to 31 July 2019. The last row reports the mean and variance equality tests using the ANOVA and Levene statistics, respectively (p values in parentheses). Skewness and Kurtosis refer to the series skewness and kurtosis coefficients. The Jarque–Bera statistic tests the normality of the series. This statistic has an asymptotic $\chi^2(2)$ distribution under the normal distribution hypothesis.

Table 4. Descriptive statistics vice ETFs.

	Mean	Std. Dev.	Skewness	Kurtosis	JB	Obs
EWH	0.000160	0.016006	0.036612	12.07174	15925.40	4644
EWW	0.000214	0.017374	−0.042895	11.33195	13434.48	4644
XLE	0.000135	0.017017	−0.459523	12.72547	18465.58	4644
XLY	0.000319	0.013302	−0.308100	9.593987	8486.981	4644
IYZ	-7.81×10^{-5}	0.014266	−0.171950	10.21673	10100.58	4644
IYE	0.000131	0.016959	−0.451586	20.31367	58162.01	4644
IYC	0.000279	0.012142	−0.165669	8.970304	6918.459	4644
RTH	0.000265	0.012463	0.194372	8.743878	6322.077	4578
IGN	0.000110	0.018155	−0.068580	6.662663	2523.337	4508
ADRA	0.000152	0.014962	0.077056	13.05149	17701.69	4204
ADRE	0.000273	0.018519	−0.061691	16.16905	30380.73	4204
VCR	0.000338	0.012645	−0.277451	10.23225	8551.869	3901
VDE	0.000136	0.017596	−0.503845	12.92643	15488.24	3734
PEJ	0.000309	0.013834	−0.112281	9.449319	6158.127	3549
PXQ	0.000385	0.015317	−0.220383	6.636194	1983.918	3549
PMR	0.000262	0.013316	0.022089	6.295554	1566.934	3462
EEB	0.000125	0.020107	−0.122840	14.33994	17341.58	3235
RXI	0.000258	0.013044	−0.528735	11.29120	9416.849	3235
RCD	0.000263	0.014872	−0.372181	13.55273	14931.22	3202
DIG	−0.000311	0.034550	−0.784812	15.72790	21551.54	3145
UCC	0.000584	0.023965	−0.327642	8.556141	4100.313	3144
CUT	1.60×10^{-5}	0.015478	−0.151200	9.708052	5540.362	2949
BJK	-3.34×10^{-5}	0.017886	−0.167787	15.17512	17918.98	2899
LTL	-2.44×10^{-6}	0.027443	−0.152472	11.93367	9375.338	2816
WOOD	5.84×10^{-5}	0.015573	−0.338799	11.72449	8911.516	2793
CQQQ	0.000243	0.016313	−0.270091	5.647560	728.9201	2396
EPHE	0.000156	0.013230	−0.204375	5.925388	808.1502	2223
XTL	0.000152	0.012199	−0.459660	7.511317	1890.078	2140
MCHI	5.69×10^{-5}	0.014826	−0.128086	5.910170	745.3652	2096
FCAN	−0.000141	0.011423	−0.038192	7.277513	1428.393	1873
Equality	**Mean**	0.333282	(0.9997)	**SD**	189.1519	(0.0000)

This table contains the descriptive statistics for the daily return series for the socially responsible ETFs for the sample period from 5 February 2001 through to 31 July 2019. The last row reports the mean and variance equality tests using the ANOVA and Levene statistics, respectively (*p* values in parentheses). Skewness and Kurtosis refer to the series skewness and kurtosis coefficients. The Jarque–Bera statistic tests the normality of the series. This statistic has an asymptotic $\chi^2(2)$ distribution under the normal distribution hypothesis.

3. Results

At this stage, with the rolling Fama–French five-factor regressions for each ETF estimated, we show in Tables 5 and 6 the performance of the two proposed strategies: the long-only strategy and the long risk-free strategy, but also those related to the naïve strategy for all the portfolios. Cumulative returns and Sharpe, Sortino, and Omega ratios (where zero and the risk-free rate are taken as the thresholds) are displayed in all cases. Due to the 60-month rolling window, these results covered the period from 17 February 2006 to 31 July 2019 (amounting to 3385 usable observations). This interval can be considered to be the "out-of-sample" period.

Table 5. Performance from responsible portfolios using a 5-year rolling window.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	93.29	0.318	0.437	1.071	1.059	119.91	0.419	0.583	1.091	1.079	41.16	0.187	0.257	1.060	1.038
P7	94.97	0.328	0.451	1.073	1.061	126.44	0.446	0.622	1.096	1.084	40.40	0.179	0.245	1.058	1.036
P8	76.33	0.249	0.341	1.058	1.046	126.44	0.446	0.622	1.096	1.084	35.42	0.155	0.212	1.055	1.032
P9	78.18	0.251	0.344	1.057	1.046	116.73	0.399	0.556	1.086	1.074	36.39	0.154	0.210	1.052	1.031
P10	80.06	0.258	0.354	1.059	1.048	116.83	0.409	0.569	1.088	1.076	43.83	0.201	0.275	1.061	1.040
P11	78.32	0.253	0.347	1.058	1.047	116.47	0.408	0.567	1.088	1.076	40.11	0.185	0.253	1.059	1.037
P12	83.57	0.267	0.366	1.060	1.049	126.32	0.410	0.570	1.084	1.074	47.11	0.220	0.300	1.062	1.042
P13	87.53	0.285	0.390	1.063	1.052	137.79	0.465	0.646	1.094	1.084	48.17	0.228	0.312	1.064	1.044
P14	84.59	0.272	0.372	1.061	1.050	135.86	0.460	0.638	1.094	1.083	48.62	0.228	0.310	1.063	1.044
P15	86.96	0.278	0.380	1.062	1.051	137.73	0.458	0.636	1.093	1.083	53.15	0.247	0.337	1.066	1.047
P16	88.54	0.283	0.387	1.062	1.052	138.35	0.457	0.635	1.093	1.082	49.81	0.225	0.306	1.061	1.043
P17	87.05	0.279	0.382	1.062	1.051	138.35	0.457	0.635	1.093	1.082	46.81	0.213	0.290	1.060	1.040
P18	88.10	0.285	0.389	1.063	1.052	135.05	0.454	0.629	1.093	1.082	49.68	0.231	0.314	1.063	1.044
P19	93.28	0.300	0.411	1.066	1.055	137.38	0.458	0.634	1.093	1.083	50.85	0.234	0.318	1.063	1.045
P20	92.35	0.297	0.406	1.065	1.055	137.38	0.458	0.634	1.093	1.083	48.58	0.225	0.306	1.062	1.043
P21	92.75	0.299	0.409	1.066	1.055	136.89	0.460	0.637	1.094	1.083	49.88	0.233	0.317	1.064	1.044
P22	91.14	0.295	0.403	1.065	1.054	136.89	0.460	0.637	1.094	1.083	47.89	0.225	0.306	1.063	1.043
P23	89.69	0.291	0.398	1.065	1.054	136.89	0.460	0.637	1.094	1.083	46.06	0.218	0.295	1.062	1.041
P24	86.96	0.283	0.386	1.063	1.052	136.89	0.460	0.637	1.094	1.083	44.50	0.211	0.286	1.061	1.040
P25	86.77	0.281	0.384	1.063	1.052	136.89	0.460	0.637	1.094	1.083	43.30	0.206	0.279	1.060	1.039
P26	85.42	0.277	0.378	1.062	1.051	136.89	0.460	0.637	1.094	1.083	42.26	0.202	0.273	1.060	1.038
P27	87.11	0.283	0.387	1.063	1.052	137.04	0.463	0.640	1.094	1.084	44.09	0.213	0.289	1.062	1.041
P28	84.77	0.270	0.368	1.060	1.050	134.10	0.444	0.613	1.091	1.080	41.92	0.192	0.260	1.057	1.037
P29	85.33	0.273	0.372	1.061	1.050	134.10	0.444	0.613	1.091	1.080	42.02	0.195	0.264	1.058	1.037
P30	86.69	0.278	0.380	1.062	1.051	137.10	0.457	0.631	1.093	1.083	43.82	0.207	0.280	1.060	1.039

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have a positive (negative) alpha of 5-year rolling window regression.

The results reported in Table 5 show that the long-only strategy clearly outperformed the naïve strategy and also the long-only risk-free one for all portfolios. We also found some interesting evidence. First, portfolios compounded by six to 12 assets showed significant increases and decreases in the performance ratios, which suggests a level of instability.

Second, the portfolio formed by the 13 assets with older inception dates (P13) reported the best performance measures for most of the ratios considered and, finally, there were no significant differences in the performance ratios for the rest of the portfolios when compared to P13. It must be pointed out that improvements around 60% in the Sharpe and Sortino ratios were obtained when the long-only strategy was applied. On the other hand, not so large but constant improvements around 3% were obtained when Omega ratios were compared among strategies.

The superior performance of the long-only strategy was also observed when we focused on Table 6 where ratios from sinner portfolios are reported, but in this case, a minimum of 15 assets were needed to improve the results of its naïve strategy and portfolios with 21 to 23 assets to obtain the best performance ratios. In this case, improvements in Sharpe and Sortino ratios when the long-only strategy was applied were lower, remaining around 20%, than those obtained with the naïve and the long-only risk-free strategies. In any case, the sinner portfolios showed worse results than those reported by the responsible ones, which means that initially an investor should opt for being a saint instead of a sinner.

Table 6. Performance from vice portfolios using a 5-year rolling window.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	41.18	0.089	0.122	1.027	1.017	26.03	0.038	0.052	1.023	1.010	14.99	0.001	0.002	1.027	1.000
P7	53.49	0.136	0.186	1.037	1.027	36.11	0.071	0.097	1.028	1.017	19.42	0.031	0.043	1.038	1.009
P8	62.33	0.173	0.237	1.045	1.034	31.95	0.056	0.076	1.023	1.012	19.94	0.038	0.053	1.041	1.010
P9	63.28	0.176	0.242	1.045	1.035	21.29	0.022	0.030	1.015	1.005	18.18	0.024	0.033	1.035	1.007
P10	57.79	0.157	0.215	1.042	1.031	18.70	0.013	0.018	1.014	1.003	15.51	0.005	0.007	1.029	1.001
P11	51.52	0.131	0.180	1.036	1.026	17.02	0.007	0.010	1.012	1.002	11.81	−0.018	−0.025	1.021	0.995
P12	59.38	0.159	0.219	1.042	1.031	16.42	0.005	0.007	1.012	1.001	10.44	−0.027	−0.038	1.019	0.992
P13	54.77	0.142	0.195	1.038	1.028	16.20	0.005	0.006	1.012	1.001	10.52	−0.027	−0.037	1.019	0.992
P14	58.59	0.155	0.213	1.041	1.031	55.04	0.130	0.178	1.038	1.027	15.27	0.003	0.004	1.027	1.001
P15	62.02	0.167	0.230	1.043	1.033	82.15	0.206	0.285	1.049	1.040	18.93	0.026	0.036	1.032	1.007
P16	63.53	0.173	0.238	1.045	1.034	77.04	0.190	0.263	1.046	1.037	18.12	0.021	0.029	1.031	1.006
P17	60.42	0.162	0.222	1.042	1.032	73.51	0.180	0.248	1.044	1.035	17.72	0.019	0.026	1.030	1.005
P18	62.47	0.169	0.232	1.044	1.033	73.54	0.180	0.249	1.044	1.035	17.20	0.015	0.021	1.030	1.004
P19	64.24	0.175	0.241	1.045	1.035	78.27	0.195	0.269	1.047	1.038	19.16	0.028	0.038	1.033	1.007
P20	59.39	0.156	0.214	1.041	1.030	78.27	0.195	0.269	1.047	1.038	18.58	0.024	0.033	1.032	1.007
P21	67.26	0.182	0.250	1.046	1.036	103.95	0.265	0.367	1.060	1.051	22.56	0.049	0.067	1.037	1.013
P22	66.79	0.181	0.248	1.045	1.035	103.95	0.265	0.367	1.060	1.051	21.84	0.044	0.061	1.036	1.012
P23	65.29	0.175	0.241	1.044	1.034	104.17	0.266	0.368	1.060	1.052	21.43	0.042	0.057	1.036	1.011
P24	64.83	0.174	0.239	1.044	1.034	91.37	0.227	0.314	1.052	1.044	19.15	0.027	0.038	1.032	1.007
P25	64.65	0.174	0.238	1.044	1.034	91.37	0.227	0.314	1.052	1.044	18.75	0.025	0.034	1.031	1.007
P26	64.99	0.174	0.240	1.044	1.034	87.58	0.217	0.299	1.050	1.042	19.22	0.028	0.038	1.032	1.007
P27	64.18	0.172	0.236	1.044	1.034	87.58	0.217	0.299	1.050	1.042	19.04	0.027	0.037	1.032	1.007
P28	64.36	0.172	0.237	1.044	1.034	87.95	0.218	0.301	1.051	1.042	18.76	0.025	0.034	1.031	1.007
P29	64.81	0.174	0.239	1.044	1.034	87.95	0.218	0.301	1.051	1.042	18.67	0.024	0.034	1.031	1.006
P30	64.41	0.173	0.237	1.044	1.034	87.95	0.218	0.301	1.051	1.042	18.65	0.024	0.034	1.031	1.006

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have positive (negative) alpha of 5-year rolling window regression.

Figure 1 and Table 7 help us to analyze the previous results in depth. Figure 1 shows the cumulative returns of the portfolio formed by 13 socially responsible ETFs (P13) following the long-only, the long-only with risk-free, and the naïve strategies. It also shows the cumulative returns for the same strategies but for the portfolio compounded by 15 vice ETFs (P15), and finally, it compares the cumulative returns of the long-only strategies for the P13 responsible portfolio and the P15 vice one.

We observed in all cases that the worst results for these strategies were provided when the rolling window employed for estimating the alphas covered the period from 2001 to 2011 (which means obtaining the first alphas in 2006 and the last ones in 2011).

This is a period of significant upward and downward trends in the economy with different crises that lead to obtaining negative returns in most of the assets on the stock markets, even the socially responsible ETFs.

On the other hand, there were significant upward trends in the cumulative returns for the portfolios when alphas were estimated in the period, which coincided with the end of the previous one (rolling sample from 2006 to 2011) and ended in 2017 (rolling sample from 2012 to 2017). Most of that period is characterized by a significant upward trend in the economy, during which it was recovering from the 2008 and the 2011 crises (dot.com and subprime crises, respectively). However, the new evidence of economic crisis in 2018 led to a decrease in the cumulative returns of the strategies, which followed the alphas that were estimated in the rolling windows ending in July 2019. We could deduce from these results that this rolling alpha procedure worked better in upward economic trends.

Table 7 reports the positive and negative alphas over the respective rolling windows (restricted to their inception dates). Focusing on the responsible ETFs, where we obtained the best performance results, we observed that there were a total of nine responsible ETFs (PBW, PZD, QCLN, PBD, PIO, IFEU, TAN, ICLN, and LIT) without positive alphas, which means that they did not contribute anything to the portfolio return when the long-only strategy was employed and only added the risk-free ratio return due to the negative alphas when the long-only with risk-free strategy was used. Most of these ETFs are related to the renewable or clean energy sectors, which were highlighted by Silva and Cortez [7], Reboredo et al. [66], and Rezec and Scholtens [67] as underperformers of their respective benchmarks.

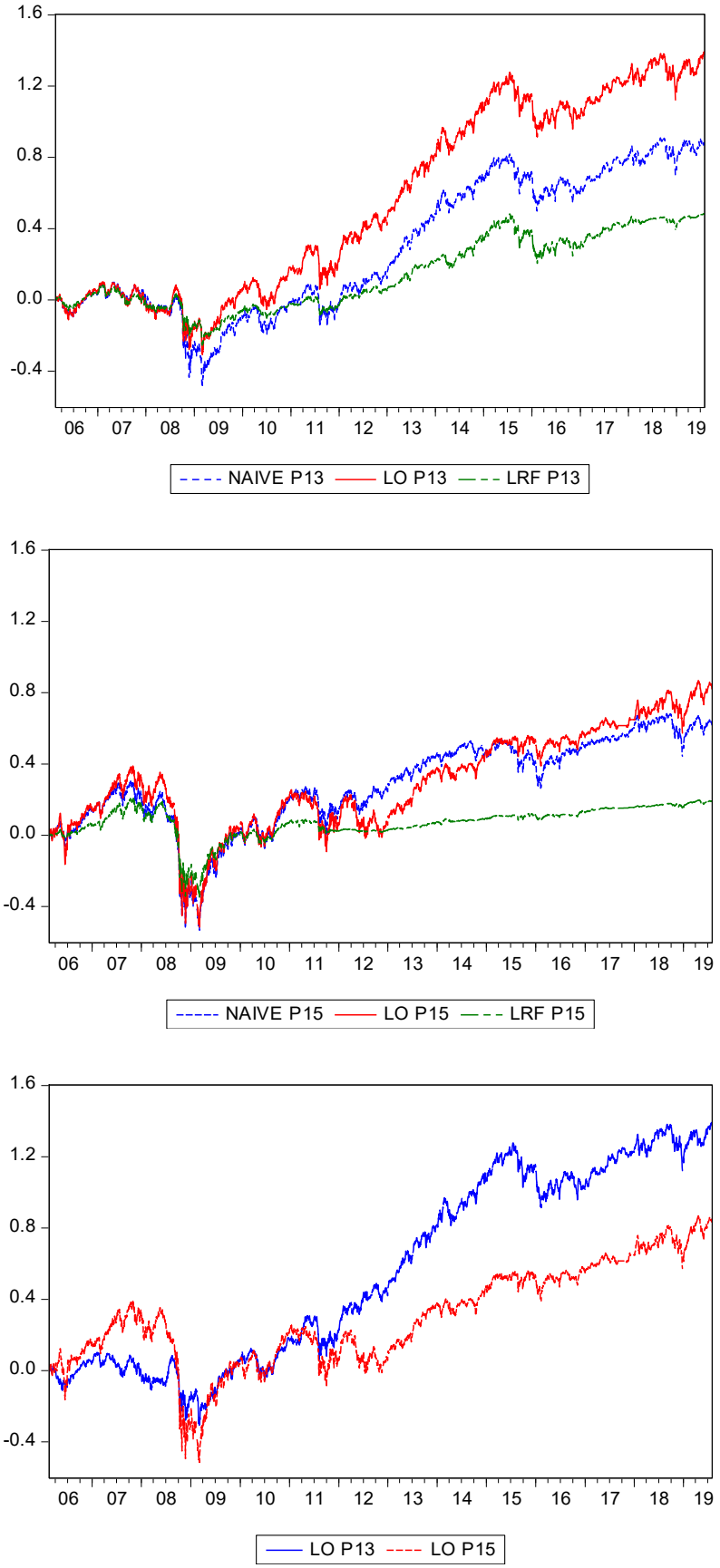

Figure 1. Cumulative returns for socially responsible investment (SRI) and vice exchange traded funds (ETFs) using different strategies.

Table 7. Positive and negative alphas over the rolling window.

Responsible ETFs						Vice ETFs					
Code	**Total**	**Poe**	**%**	**Neg**	**%**	**Code**		**Pos**	**%**	**Neg**	**%**
XLV	3385	1810	53.47	1575	46.53	EWH	3385	1260	37.22	2125	62.78
BBH	3385	1816	53.65	1569	46.35	EWW	3385	1438	42.48	1947	57.52
PPH	3385	483	14.27	2902	85.73	XLE	3385	737	21.77	2648	78.23
IYH	3385	2284	67.47	1101	32.53	XLY	3385	480	14.18	2905	85.82
ICF	3385	555	16.40	2830	83.60	IYZ	3385	172	5.08	3213	94.92
IBB	3385	2712	80.12	673	19.88	IYE	3385	878	25.94	2507	74.06
VHT	2641	1720	65.13	921	34.87	IYC	3385	967	28.57	2418	71.43
PBW	2367	0	0.00	2367	100.00	RTH	3318	943	28.42	2375	71.58
PBE	2289	1408	61.51	881	38.49	IGN	3248	1259	38.76	1989	61.24
PJP	2289	1745	76.23	544	23.77	ADRA	2944	723	24.56	2221	75.44
PHO	2174	17	0.78	2157	99.22	ADRE	2944	976	33.15	1968	66.85
XBI	2133	2029	95.12	104	4.88	VCR	2641	566	21.43	2075	78.57
IHI	2071	1378	66.54	693	33.46	VDE	2474	105	4.24	2369	95.76
XPH	2038	1287	63.15	751	36.85	PEJ	2289	944	41.24	1345	58.76
FBT	2037	1974	96.91	63	3.09	PXQ	2289	1261	55.09	1028	44.91
PTH	1960	954	48.67	1006	51.33	PMR	2202	379	17.21	1823	82.79
PZD	1952	0	0.00	1952	100.00	EEB	1975	70	3.54	1905	96.46
RYH	1942	1837	94.59	105	5.41	RXI	1975	23	1.16	1952	98.84
RXL	1885	1070	56.76	815	43.24	RCD	1942	542	27.91	1400	72.09
QCLN	1876	0	0.00	1876	100.00	DIG	1885	0	0.00	1885	100.00
FXH	1817	1505	82.83	312	17.17	UCC	1884	1402	74.42	482	25.58
PBD	1794	0	0.00	1794	100.00	CUT	1689	0	0.00	1689	100.00
PIO	1794	0	0.00	1794	100.00	BJK	1639	146	8.91	1493	91.09
IFEU	1657	0	0.00	1657	100.00	LTL	1572	547	34.80	1025	65.20
TAN	1583	0	0.00	1583	100.00	WOOD	1533	0	0.00	1533	100.00
ICLN	1533	0	0.00	1533	100.00	CQQQ	1136	251	22.10	885	77.90
PSCH	1085	1085	100.00	0	0.00	EPHE	963	0	0.00	963	100.00
BIB	1083	539	49.77	544	50.23	XTL	880	22	2.50	858	97.50
LIT	1010	0	0.00	1010	100.00	MCHI	837	0	0.00	837	100.00
XHE	880	880	100.00	0	0.00	FCAN	613	0	0.00	613	100.00

On the other hand, there are ETFs such as IBB, XBI, FBT, RYH, PSCH and XHE that help to improve the performance of the portfolios with their high percentage of positive alphas. Most of them are related to the healthcare sector, as pointed out by Schramade [68] and Betti et al. [11] as the most investable and important sector for achieving the Sustainable Development Goals and, therefore, a perfect way to respond to the responsible (saint) preferences of the investors.

In essence, it has been clearly shown that saint investors obtain better performances than sinner ones, that it is more profitable to use a long-only strategy preferably on upward trends, and that it is more appropriate to invest in healthcare ETFs than in those focused on the renewable energy sector.

4. Discussion

For the sake of providing more robustness to our results, we consider transaction costs but also another approach. Following Blitz and Huij [69], who stated that funds underperform market portfolios due to expense ratios, we consider a 0.56% annual expense ratio (which corresponds to the mean of the expense ratios from the ETFs considered in this paper). The out-of-sample portfolio performance results are shown in Tables 8 and 9. We observe that the profitability of our proposal takes into account expense ratios sufficiently, and, once again, the suitability of investing in socially responsible ETFs instead of investing in vice ETFs is proved.

Table 8. Performance from responsible portfolios using a 5-year rolling window considering transaction costs.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	61.70	0.190	0.260	1.046	1.035	115.10	0.399	0.556	1.087	1.076	35.90	0.150	0.206	1.052	1.030
P7	59.27	0.182	0.249	1.045	1.034	121.51	0.427	0.594	1.092	1.080	35.14	0.142	0.195	1.050	1.029
P8	36.94	0.090	0.122	1.027	1.016	121.51	0.427	0.594	1.092	1.080	30.16	0.116	0.158	1.046	1.023
P9	35.23	0.081	0.110	1.025	1.015	111.79	0.380	0.529	1.082	1.071	31.12	0.116	0.159	1.045	1.023
P10	33.56	0.074	0.101	1.024	1.013	111.89	0.390	0.541	1.084	1.072	38.57	0.165	0.225	1.053	1.033
P11	28.44	0.054	0.074	1.021	1.010	111.53	0.388	0.539	1.084	1.072	34.84	0.147	0.200	1.051	1.029
P12	30.37	0.061	0.082	1.021	1.011	121.12	0.391	0.543	1.081	1.070	41.85	0.184	0.251	1.055	1.035
P13	31.11	0.064	0.087	1.022	1.012	132.53	0.445	0.618	1.091	1.080	42.90	0.192	0.262	1.056	1.037
P14	24.99	0.040	0.054	1.018	1.007	130.59	0.440	0.610	1.090	1.079	43.36	0.192	0.262	1.056	1.037
P15	24.20	0.036	0.049	1.017	1.007	132.47	0.438	0.608	1.089	1.079	47.88	0.213	0.290	1.059	1.040
P16	22.73	0.031	0.041	1.016	1.005	133.08	0.438	0.607	1.089	1.079	44.54	0.191	0.260	1.055	1.036
P17	18.20	0.013	0.018	1.013	1.002	133.08	0.438	0.607	1.089	1.079	41.55	0.178	0.242	1.053	1.034
P18	16.22	0.006	0.008	1.011	1.001	129.78	0.434	0.601	1.089	1.078	44.42	0.196	0.267	1.056	1.037
P19	18.47	0.014	0.019	1.013	1.003	132.12	0.438	0.606	1.089	1.079	45.59	0.200	0.271	1.057	1.038
P20	14.63	0.000	−0.001	1.010	1.000	132.12	0.438	0.606	1.089	1.079	43.31	0.190	0.258	1.055	1.036
P21	12.20	−0.010	−0.013	1.008	0.998	131.62	0.441	0.609	1.090	1.080	44.61	0.198	0.269	1.057	1.038
P22	7.80	−0.027	−0.036	1.005	0.995	131.62	0.441	0.609	1.090	1.080	42.62	0.189	0.257	1.055	1.036
P23	3.56	−0.044	−0.059	1.002	0.992	131.62	0.441	0.609	1.090	1.080	40.80	0.181	0.245	1.054	1.034
P24	−1.75	−0.065	−0.087	0.999	0.988	131.62	0.441	0.609	1.090	1.080	39.23	0.173	0.235	1.053	1.033
P25	−4.40	−0.075	−0.101	0.997	0.987	131.62	0.441	0.609	1.090	1.080	38.03	0.168	0.227	1.053	1.032
P26	−8.13	−0.090	−0.121	0.994	0.984	131.62	0.441	0.609	1.090	1.080	36.99	0.163	0.220	1.052	1.031
P27	−8.13	−0.090	−0.121	0.994	0.984	131.77	0.443	0.612	1.090	1.080	38.83	0.175	0.237	1.054	1.033
P28	−12.16	−0.104	−0.140	0.992	0.982	128.84	0.424	0.585	1.087	1.077	36.65	0.155	0.209	1.050	1.029
P29	−13.16	−0.108	−0.145	0.991	0.981	128.84	0.424	0.585	1.087	1.077	36.76	0.157	0.213	1.050	1.030
P30	−13.18	−0.108	−0.145	0.991	0.981	131.84	0.437	0.603	1.089	1.079	38.55	0.170	0.229	1.053	1.032

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have positive (negative) alpha of 5-year rolling window regression.

Table 9. Performance from vice portfolios using a 5-year rolling window considering transaction costs.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	9.59	−0.017	−0.024	1.006	0.997	23.05	0.028	0.038	1.020	1.007	9.72	−0.029	−0.040	1.017	0.991
P7	16.63	0.007	0.009	1.011	1.001	32.37	0.058	0.080	1.025	1.014	14.16	−0.004	−0.005	1.027	0.999
P8	20.31	0.020	0.028	1.014	1.004	27.82	0.042	0.058	1.020	1.009	14.67	−0.001	−0.001	1.030	1.000
P9	16.21	0.005	0.007	1.011	1.001	17.07	0.008	0.010	1.012	1.002	12.91	−0.013	−0.018	1.025	0.996
P10	6.14	−0.031	−0.043	1.004	0.994	14.47	−0.001	−0.001	1.010	1.000	10.25	−0.030	−0.042	1.019	0.992
P11	−4.72	−0.069	−0.094	0.997	0.987	12.79	−0.006	−0.009	1.009	0.999	6.54	−0.051	−0.070	1.012	0.986
P12	−0.96	−0.056	−0.076	0.999	0.989	12.19	−0.008	−0.011	1.009	0.998	5.17	−0.060	−0.083	1.009	0.983
P13	−9.42	−0.086	−0.117	0.994	0.984	11.97	−0.009	−0.012	1.009	0.998	5.26	−0.060	−0.083	1.010	0.983
P14	−9.15	−0.085	−0.115	0.994	0.984	50.46	0.115	0.158	1.034	1.024	10.01	−0.030	−0.041	1.018	0.992
P15	−9.29	−0.085	−0.116	0.994	0.984	76.98	0.190	0.263	1.046	1.037	13.67	−0.007	−0.009	1.023	0.998
P16	−11.20	−0.092	−0.126	0.992	0.982	71.87	0.174	0.241	1.043	1.034	12.85	−0.012	−0.016	1.022	0.997
P17	−17.39	−0.114	−0.155	0.988	0.978	68.34	0.164	0.226	1.041	1.032	12.45	−0.014	−0.020	1.021	0.996
P18	−18.41	−0.117	−0.160	0.987	0.977	68.37	0.164	0.227	1.041	1.032	11.93	−0.018	−0.024	1.020	0.995
P19	−19.66	−0.122	−0.166	0.987	0.977	73.11	0.179	0.247	1.044	1.035	13.89	−0.005	−0.007	1.024	0.999
P20	−27.45	−0.147	−0.200	0.982	0.972	73.11	0.179	0.247	1.044	1.035	13.31	−0.009	−0.012	1.023	0.998
P21	−22.51	−0.129	−0.176	0.985	0.975	98.68	0.249	0.345	1.057	1.048	17.30	0.016	0.022	1.028	1.004
P22	−25.61	−0.140	−0.190	0.983	0.973	98.68	0.249	0.345	1.057	1.048	16.57	0.011	0.016	1.027	1.003
P23	−29.65	−0.154	−0.209	0.980	0.971	98.90	0.250	0.346	1.057	1.048	16.17	0.009	0.012	1.027	1.002
P24	−32.56	−0.164	−0.223	0.979	0.969	86.10	0.212	0.292	1.049	1.041	13.88	−0.005	−0.008	1.023	0.999
P25	−35.12	−0.173	−0.235	0.977	0.967	86.10	0.212	0.292	1.049	1.041	13.49	−0.008	−0.011	1.022	0.998
P26	−36.54	−0.178	−0.242	0.976	0.966	82.31	0.201	0.277	1.047	1.039	13.95	−0.005	−0.007	1.023	0.999
P27	−38.86	−0.186	−0.253	0.974	0.965	82.31	0.201	0.277	1.047	1.039	13.77	−0.006	−0.008	1.023	0.998
P28	−40.04	−0.191	−0.259	0.974	0.964	82.69	0.202	0.279	1.047	1.039	13.50	−0.008	−0.011	1.023	0.998
P29	−40.90	−0.193	−0.262	0.973	0.964	82.69	0.202	0.279	1.047	1.039	13.40	−0.008	−0.012	1.022	0.998
P30	−42.25	−0.198	−0.269	0.972	0.963	82.69	0.202	0.279	1.047	1.039	13.38	−0.009	−0.012	1.022	0.998

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have a positive (negative) alpha of 5-year rolling window regression.

There are some authors such as Bauer et al. [28], Humphrey and Tan [70], or Sarwar et al. [42], among others, who have proposed using a 3-year rolling window for estimating the alphas. We also considered that procedure in order to compare the results with those obtained previously using a

5-year rolling window. In order to analyze this alternative procedure using the same terms as the previous one, we report the results in Tables 10 and 11.

Table 10. Performance from responsible portfolios using a 3-year rolling window considering transaction costs.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	61.70	0.190	0.260	1.046	1.035	76.61	0.274	0.381	1.070	1.056	27.22	0.077	0.104	1.039	1.018
P7	59.85	0.186	0.254	1.046	1.034	77.63	0.284	0.394	1.072	1.058	30.52	0.096	0.131	1.044	1.022
P8	27.54	0.051	0.069	1.020	1.009	78.90	0.280	0.386	1.071	1.057	15.29	0.003	0.004	1.023	1.001
P9	27.28	0.049	0.066	1.019	1.009	83.23	0.292	0.404	1.073	1.060	17.31	0.015	0.020	1.025	1.004
P10	27.36	0.049	0.067	1.020	1.009	107.63	0.385	0.533	1.090	1.077	28.40	0.080	0.107	1.039	1.018
P11	21.95	0.028	0.038	1.016	1.005	112.22	0.401	0.555	1.092	1.079	25.44	0.064	0.086	1.036	1.015
P12	21.70	0.027	0.036	1.015	1.005	139.72	0.465	0.651	1.099	1.088	31.21	0.094	0.127	1.040	1.021
P13	22.50	0.030	0.040	1.016	1.005	147.43	0.499	0.691	1.102	1.091	34.04	0.111	0.150	1.044	1.024
P14	17.12	0.009	0.012	1.012	1.002	143.55	0.484	0.669	1.099	1.089	36.81	0.126	0.169	1.046	1.027
P15	18.08	0.013	0.017	1.012	1.002	134.32	0.439	0.606	1.090	1.080	40.79	0.144	0.195	1.049	1.031
P16	16.54	0.007	0.009	1.011	1.001	130.25	0.420	0.578	1.087	1.076	39.25	0.136	0.183	1.047	1.029
P17	10.03	−0.018	−0.024	1.007	0.997	117.29	0.375	0.515	1.078	1.068	34.60	0.112	0.151	1.042	1.024
P18	7.66	−0.027	−0.036	1.005	0.995	112.52	0.364	0.500	1.077	1.066	36.91	0.125	0.168	1.044	1.026
P19	9.44	−0.020	−0.027	1.006	0.996	115.05	0.370	0.508	1.078	1.067	38.48	0.132	0.178	1.046	1.028
P20	2.35	−0.046	−0.062	1.002	0.992	114.23	0.368	0.504	1.077	1.067	34.78	0.113	0.153	1.042	1.024
P21	−0.33	−0.057	−0.076	1.000	0.990	114.24	0.370	0.508	1.078	1.068	36.65	0.123	0.166	1.044	1.026
P22	−8.81	−0.089	−0.119	0.994	0.984	114.24	0.370	0.508	1.078	1.068	34.14	0.111	0.149	1.042	1.024
P23	−14.61	−0.111	−0.149	0.990	0.980	114.24	0.370	0.508	1.078	1.068	31.85	0.099	0.134	1.040	1.021
P24	−20.75	−0.136	−0.182	0.986	0.976	113.75	0.369	0.505	1.078	1.067	29.90	0.089	0.120	1.039	1.019
P25	−31.31	−0.175	−0.234	0.979	0.969	112.34	0.363	0.498	1.077	1.066	26.92	0.072	0.097	1.035	1.016
P26	−38.63	−0.203	−0.271	0.974	0.964	112.34	0.363	0.498	1.077	1.066	25.45	0.064	0.086	1.034	1.014
P27	−39.23	−0.205	−0.274	0.973	0.963	116.49	0.381	0.522	1.080	1.070	28.27	0.081	0.108	1.037	1.018
P28	−40.94	−0.207	−0.277	0.973	0.963	118.71	0.381	0.522	1.080	1.069	29.60	0.086	0.116	1.038	1.019
P29	−44.73	−0.222	−0.297	0.970	0.961	115.18	0.369	0.505	1.077	1.067	27.67	0.076	0.102	1.036	1.016
P30	−45.34	−0.225	−0.300	0.970	0.960	118.29	0.383	0.525	1.080	1.070	29.46	0.086	0.116	1.038	1.019

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have a positive (negative) alpha of 5-year rolling window regression.

Table 11. Performance from vice portfolios using a 3-year rolling window considering transaction costs.

	NAIVE					LONG-ONLY					LONG-ONLY RISK FREE				
	CR	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**	**CR**	**SH**	**SOR**	**OM 0**	**OM RF**
P6	9.59	−0.017	−0.024	1.006	0.997	62.78	0.177	0.249	1.061	1.046	11.98	−0.020	−0.027	1.026	0.994
P7	16.63	0.007	0.009	1.011	1.001	85.96	0.262	0.370	1.079	1.065	14.51	−0.002	−0.003	1.033	0.999
P8	19.83	0.018	0.025	1.014	1.004	84.62	0.256	0.362	1.076	1.062	18.24	0.031	0.043	1.044	1.008
P9	13.02	−0.006	−0.009	1.009	0.999	76.00	0.225	0.314	1.063	1.051	8.82	−0.050	−0.068	1.020	0.987
P10	2.23	−0.046	−0.062	1.002	0.991	75.40	0.222	0.310	1.063	1.050	4.67	−0.079	−0.108	1.010	0.978
P11	−6.18	−0.074	−0.101	0.996	0.986	79.04	0.226	0.316	1.063	1.051	7.21	−0.053	−0.072	1.014	0.985
P12	−5.33	−0.072	−0.097	0.996	0.986	76.43	0.219	0.305	1.062	1.050	9.68	−0.038	−0.052	1.020	0.990
P13	−14.53	−0.103	−0.140	0.990	0.980	77.72	0.223	0.312	1.063	1.051	10.85	−0.030	−0.041	1.023	0.992
P14	−13.09	−0.099	−0.134	0.991	0.981	78.18	0.213	0.295	1.057	1.046	14.15	−0.005	−0.007	1.030	0.999
P15	−11.58	−0.094	−0.127	0.992	0.982	104.78	0.293	0.404	1.068	1.058	19.68	0.038	0.052	1.038	1.009
P16	−14.45	−0.105	−0.142	0.990	0.980	101.01	0.281	0.388	1.065	1.055	18.68	0.031	0.042	1.036	1.008
P17	−22.65	−0.134	−0.181	0.985	0.975	93.38	0.256	0.353	1.060	1.050	19.48	0.037	0.050	1.038	1.009
P18	−24.32	−0.140	−0.189	0.983	0.973	93.33	0.256	0.353	1.060	1.050	18.30	0.028	0.038	1.036	1.007
P19	−25.68	−0.145	−0.196	0.982	0.973	95.39	0.266	0.366	1.062	1.052	17.81	0.024	0.033	1.035	1.006
P20	−33.91	−0.170	−0.229	0.978	0.968	95.39	0.266	0.366	1.062	1.052	16.96	0.017	0.024	1.033	1.004
P21	−28.13	−0.148	−0.200	0.982	0.972	102.38	0.282	0.387	1.065	1.055	18.59	0.030	0.041	1.035	1.007
P22	−32.91	−0.165	−0.222	0.979	0.969	102.17	0.281	0.386	1.065	1.055	17.94	0.025	0.034	1.034	1.006
P23	−37.58	−0.181	−0.244	0.976	0.966	99.27	0.270	0.370	1.062	1.052	17.07	0.018	0.025	1.033	1.004
P24	−40.91	−0.192	−0.259	0.973	0.964	80.13	0.208	0.285	1.049	1.040	14.84	0.001	0.001	1.028	1.000
P25	−44.57	−0.205	−0.276	0.971	0.962	66.06	0.164	0.225	1.041	1.032	13.74	−0.008	−0.011	1.026	0.998
P26	−46.05	−0.210	−0.283	0.970	0.961	59.66	0.142	0.195	1.036	1.027	12.78	−0.016	−0.021	1.024	0.996
P27	−48.85	−0.220	−0.296	0.968	0.959	60.49	0.145	0.199	1.037	1.028	12.96	−0.014	−0.019	1.025	0.997
P28	−50.75	−0.227	−0.305	0.967	0.958	61.79	0.149	0.204	1.038	1.028	13.29	−0.012	−0.016	1.025	0.997
P29	−52.37	−0.232	−0.312	0.966	0.957	61.79	0.149	0.204	1.038	1.028	13.26	−0.012	−0.016	1.026	0.997
P30	−55.24	−0.242	−0.326	0.964	0.955	61.79	0.149	0.204	1.038	1.028	13.34	−0.011	−0.015	1.026	0.997

This table shows the portfolio performance after applying the different strategies. The values of cumulative returns (CR) are reported as percentages. Performance ratios are Sharpe (SH), Sortino (SOR), and Omega with a zero threshold (OM0) and risk-free threshold (OMRF). Strategies take a long (invest in 1-month U.S. T-Bill) position in the portfolio that have a positive (negative) alpha of 5-year rolling window regression.

We used a 3-year rolling window for the same "out-of-sample" period that was employed for the 5-year rolling average, that is, from 17 February 2006 to 31 July 2019 (amounting to 3385 usable observations) as well as the transaction costs. We found profitable strategies for both social (saint) and vice (sinner) ETFs and, once again, we obtained better performance results for the saint ETFs. However, these results did not outperform those obtained using the previous procedure (see Tables 8 and 9) that employed a five-year rolling window, which was found to be the better procedure.

Therefore, we have shown the adequacy of the suggested methodology for improving the performance of investments, especially in responsible ones, in spite of some limitations that, however, do not lend merit to the results. First, we found just a few of ETFs with long inception dates, which led us to limit the sample and so were not able to analyze different periods of time. Second, we did not perform statistical significance tests to the different results such as those suggested by Burchi [71] or Herzel et al. [57] due to the high volume of performance measures that would make their exhibition cumbersome.

5. Conclusions

Given the different studies showing the profitability of the "triumvirate of Sin" investments (alcohol, tobacco, and gambling), investors may be unsure whether to invest in these sectors and become "sinners", or remain "saints" and invest in socially responsible sectors.

This paper has analysed this uncertainty by developing various investment strategies based on the value of the alphas which are obtained from the estimation of the Fama-French five-factor model. Therefore, we estimated several portfolios using a spanning procedure, which to the best of our knowledge, has not been applied previously, and we analyzed whether the inclusion of assets improved the portfolio performance.

We have shown that saint investors obtain better performance measures than sinner investors using different rolling windows even when transaction costs are considered. We have demonstrated the suitability of investing in socially responsible ETFs instead of socially irresponsible ETFs, and the suitability of using a long-only strategy, which is the most profitable in spite of some limits related to the lack of availability of long inception dates or the absence of statistical significance tests. These limits do not take merits to the results but they must be taken into account in future research in order to improve the empirical evidence as well as comparing their performance with ETFs which track indices such as the Dow Jones Industrial average or the S&P500. To sum up, these better results for the socially responsible investment could be explained by the fact that ETFs are quickly becoming favourite investment for millennials who look to make a profit while making a positive difference in the world. Individual and institutional investors can employ this approach to increase the economic value to their investment strategies.

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