

## Review

# The agency cost of investing in ethical funds: A style analysis approach

Hande Ayaydın Hacıömeroğlu<sup>a</sup>, Seza Danişoğlu<sup>a,\*</sup>, Z. Nuray Güner<sup>a</sup>, Baki Cem Şahin<sup>b</sup>

<sup>a</sup> Department of Business Administration, Middle East Technical University, Dumlupınar Bulvarı No: 1, Ankara 06800 Türkiye

<sup>b</sup> Central Bank of Türkiye, Küçüksu Caddesi No: 64/B, Ümraniye, İstanbul, Türkiye

Received 1 August 2022; revised 13 November 2022; accepted 13 November 2022

Available online 18 November 2022

## Abstract

This study aims to determine whether ethical funds make portfolio choices in line with their investment mandates. Our results show that during the first half of the sample period, it is much more difficult to distinguish the investment styles of ethical and conventional funds. The potential for ethical fund investors to face agency conflicts from investing in portfolios that are not necessarily in line with their preferences based on environmental, social, and governance (ESG) criteria is higher in the earlier years. In the second half of the sample period, ethical funds appear to invest more in large stocks that have higher ESG ratings than their conventional counterparts. Even though both fund classes have decreased their allocation to ESG-based investment alternatives in recent years, they seem to have slightly more distinct investment styles. Copyright © 2022 Borsa İstanbul Anonim Şirketi. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

*JEL classifications:* G11; G23; G41

*Keywords:* Agency cost; Blended-value investing; Democratic orthogonalization; Ethical funds; Style analysis

## 1. Introduction<sup>1</sup>

With the increased popularity of ethical funds, many studies have asked the question “Does it pay to be good?” (Barnett & Salomon, 2012) and compared such investments with conventional alternatives in terms of return performance. Ethical funds have an investment mandate for either positively screening stocks that, according to Renneboog et al. (2008), meet a threshold performance based on environmental, social, corporate governance, or ethical criteria or negatively screening

stocks by avoiding any that are issued by companies operating in the so-called sin industries. Investors in ethical funds have either purely social objectives or a blended objective of generating social and financial returns simultaneously. An issue less discussed is whether the portfolios formed by fund managers adhere to the “ethical standards” that the fund's investors have in mind when they first choose the fund.

In his presidential address at the American Finance Association Meetings in 2000, Allen (2001, p. 1166) raised the following question: “How can it be that when you give your money to a financial institution there is no agency problem, but when you give your money to a firm there is?”

Allen's question implies that the relationship between ethical fund managers and investors can be viewed as an agency relationship because the manager's job is to form a portfolio that satisfies the ethical and social criteria that the fund investors would impose on a portfolio of their own. In fact, such an agency conflict could exist between the managers and investors of any type of mutual fund because mutual funds declare an investment strategy or style in their prospectuses, which typically serve as a basis for the investor's fund

\* Corresponding author.

*E-mail addresses:* [hande@metu.edu.tr](mailto:hande@metu.edu.tr) (H. Ayaydın Hacıömeroğlu), [seza@metu.edu.tr](mailto:seza@metu.edu.tr) (S. Danişoğlu), [nurayg@metu.edu.tr](mailto:nurayg@metu.edu.tr) (Z.N. Güner), [bakicemsahin@gmail.com](mailto:bakicemsahin@gmail.com) (B. Cem Şahin).

Peer review under responsibility of Borsa İstanbul Anonim Şirketi.

<sup>1</sup> The authors thank an anonymous referee as well as the seminar participants at ISIRC (International Social Innovation Research Conference) Meetings at the Sheffield University Management School in 2020 and Eighth Finance Workshop at the Özyeğin University Faculty of Business in 2022 for valuable comments. Also, the authors gratefully acknowledge İş Investment for paying the fee for METU's access to Refinitiv Eikon.

selection. One way to understand whether fund investors bear any cost because of this agency relationship is to determine whether a fund is managed by following the style that is stated in its prospectus. In this context, the “agency cost” refers to misalignment between the investors' preferred investment style (e.g., an ethical investment style) and the fund's actual style adopted by the fund manager in forming the portfolio. If the fund's investments can be shown to be in agreement with the fund's publicized style (e.g., Refinitiv Eikon's “ethical” designation for the fund), then the fund investors bear no apparent agency cost. However, if the fund is shown to “drift” from its publicized style, then it is possible to conclude that the fund's investors incur an agency cost because the fund's portfolio might not have the characteristics that its investors prefer (Gangi & Varrone, 2018; Holmström, 1979).

In the literature, many different methodologies are proposed for determining the investment style of mutual funds, comparing the style implied by the econometric methodology against the style that is either announced by the fund or attributed to the fund by a third party, such as a data vendor. This study adopts the widely used Sharpe methodology (Sharpe, 1992) for determining the style of ethical versus conventional funds, with the objective of understanding the extent to which ethical fund managers use social and ethical criteria in their asset allocation decisions. The a priori expectation is to find that ethical funds emphasize ethical and social criteria in their portfolio allocations in a manner that is decidedly different from that of conventional funds. Sharpe's methodology views the portfolio formation process of a mutual fund as one of allocating the fund's budget among a number of major asset classes. A fund's investment style is identified by examining how closely the fund's returns move with the returns of these asset classes. In his 1992 study, Sharpe identifies 12 asset classes that represent the exhaustive set of investment alternatives available to different types of mutual funds. In this study, our analyses focus on ethical and conventional equity funds that invest only in the US equity market. Therefore, in addition to Sharpe's equity market-related asset classes that represent the “conventional” investment alternatives, an “ethical investment” asset class is introduced in order to examine whether the styles of conventional versus ethical funds differ from each other. The challenge in introducing “ethical investments” as an asset class comes from the lack of a consensus in the market as to what making an ethical investment actually means. The question of how to define an ethical investment has more answers in shades of gray than those in clear-cut black and white. One commonly accepted measure of “socially responsible” or “ethical” investment is the rating given to companies based on environmental, social, and governance (ESG) criteria.<sup>2</sup> Because the asset classes are represented by different return indexes in Sharpe's study, this study adopts the ESG-based indexes compiled by MSCI to

proxy for returns earned from “ethical investment” assets. On its website, MSCI states that it constructs the ESG-based indexes so as to “represent the performance of the most common ESG investment approaches by including, re-weighting or excluding companies by leveraging ESG criteria.”<sup>3</sup> The hypothesis in this study is that if ethical funds emphasize the ethical and social criteria more than conventional funds do, then ethical fund returns should be found to move more closely with the MSCI ESG Index returns than with the returns on “conventional” asset classes compared to the conventional fund returns. Our analyses reveal whether an agency conflict arises between the managers of and investors in ethical funds by demonstrating how closely the ethical fund returns track the returns on ESG-based return indexes.

In an early study on the subject, diBartolomeo and Witkowski (1997) argue that it is necessary to identify a fund's style so that individual and institutional investors can make investment decisions that are consistent with their risk-return preferences. When the fund in question is either self-reported or classified by a third party as “ethical,” the “style” issue becomes multidimensional because, in addition to risk versus return, the fund now also has an objective of satisfying investors' preferences regarding the social return generated by the fund's investments. Although Starks (2021) argues that the debate over whether ESG issues are part of the investment decision has waged for the past 60 years, the discussion certainly has become more heated in the past decade. In fact, Przychodzen et al. (2016) report survey findings from five countries and present evidence that fund managers tend to incorporate ESG factors into their portfolio decisions. Interestingly, the willingness to use ESG as a criterion is motivated by a desire to mitigate the portfolio risk in the short term and by the tendency toward herding, not necessarily by the investment's potential for creating financial value. Erragragui and Lagoarde-Segot (2016), however, argue that the difference between “socially responsible” and conventional investment might be insignificant because ethical investment has become increasingly mainstream, as ethical stocks are added to conventional indexes and conventional stocks are included in ethical indexes. In an environment in which it is not absolutely clear how to measure the social impact (ESG) of companies (Parguel et al., 2011), and companies engaging in greenwashing,<sup>4</sup> it might not be possible to distinguish between ethical and conventional investment very easily. This raises the question of whether fund investors as well as fund managers fully understand what it means to form and maintain an “ethical” portfolio.

Previous studies show that, when the stated investment objective of conventional funds is compared to the style determined by either the Sharpe methodology (Bams et al., 2017; diBartolomeo & Witkowski, 1997) or by a portfolio characteristics-based methodology (Chen et al., 2021; Daniel et al., 1997; Kim et al., 2000; Sensoy, 2009; Wermers,

<sup>3</sup> <https://www.msci.com/our-solutions/indexes/esg-indexes/>, accessed October 1, 2022.

<sup>4</sup> The term “greenwashing” is used to refer to the activities of companies that spend more resources on advertising themselves as environmentally friendly than on actually trying to minimize their impact on the environment.

<sup>2</sup> An ESG rating measures a company's exposure to long-term environmental, social, and governance risks. These ratings are given to companies by organizations such as Refinitiv Eikon, Bloomberg, and MSCI.

2012), a considerable proportion are found to be misclassified. In addition, fund styles do not appear to be very different from one another even though the styles announced may be very distinct (Chan, Hsiu-Lang et al., 2002; Reddy et al., 2017) and change over time (Brown et al., 2015; Brown & Goetzmann, 1997; Swinkels & Van Der Sluis, 2006; Wermers, 2012). Misclassified and changing fund styles directly indicate the fund investors' potential for incurring agency costs because they are expected to base their initial decision to invest in the fund at least partially on the fund's publicized style. Furthermore, ethical fund investors face a more complex form of agency relationship because previous studies show that ethical concerns may not be as significant investment criteria as is implied by the fund's ethical designation (Bauer et al., 2005; Briere et al., 2017; Gangi & Varrone, 2018; Madhavan et al., 2021).

This study contributes to the literature by applying Sharpe's methodology to show whether ethical funds make choices in line with their investment mandates. The methodology reveals a fund's investment style by estimating how closely the fund's returns move with the returns on major asset classes. If the fund returns have a high and significant "loading" with respect to the returns of an asset class, then the fund's investment style is identified as emphasizing that particular asset class, such as value versus growth or large-cap versus small-cap. In this study, we expect to find that ethical funds emphasize the ESG-based asset classes more than conventional funds do. Our results show that in the first half of the sample period, it is more difficult to distinguish the investment styles of ethical and conventional funds. In other words, the potential for ethical fund investors to face an agency conflict is higher during the earlier years because it is not clear whether ethical funds make portfolio allocations that emphasize ESG-based criteria more strongly. In the second half of the sample period, ethical funds appear to invest more in large stocks that have higher ESG ratings than their conventional counterparts do. Therefore, the two fund classes seem to have slightly more distinct investment styles in more recent years, even though they both decrease their allocation to ESG-based investment alternatives during this period.

The remainder of the study is organized as follows. Section 2 describes the data. Section 3 provides preliminary evidence regarding the possible misclassification of ethical funds. Section 4 describes and applies the Sharpe methodology (1992) and compares ethical funds to conventional funds. Section 5 presents the empirical findings, Section 6 discusses some robustness checks, and Section 7 concludes the study.

## 2. Data

Data on US equity open-end mutual funds that also specify the US as their geographic focus are downloaded from the Refinitiv Eikon database.<sup>5</sup> Of the 2090 mutual funds, 155 are labeled as "ethical" by Refinitiv Eikon, and the remainder are

classified as "conventional." Monthly total returns on the funds are obtained from the same database. Refinitiv Eikon classifies a fund as "ethical" based on the fund documentation that it obtains from the fund management companies. Also, funds are reviewed periodically, and, if the fund objectives or investment strategies identified during the reviews are changed, then the fund's "ethical" designation might be revoked.<sup>6</sup>

Both conventional and ethical investment style factors are proxied by MSCI indexes obtained from the MSCI website: MSCI US Small-Cap Value Index, MSCI US Mid- and Large-Cap Value Index, MSCI US Small-Cap Growth Index, MSCI US Mid- and Large-Cap Growth Index, MSCI US Small-Cap ESG Leaders Index, and MSCI US Mid- and Large-Cap ESG Leaders Index. The data for the MSCI US Mid- and Large-Cap ESG Leaders Index series start in August 2002; therefore, the sample period for the study is September 2002 to May 2022.<sup>7</sup>

The MSCI ESG Leaders indexes are based on portfolios that include the companies with the highest ESG-rated performance in each sector and avoid all companies involved in the so-called sin industries.<sup>8</sup> These indexes also reflect the relative sector weights used in the MSCI Global Investable Market Indexes in order to limit the systemic risk that can be introduced by the ESG selection process.<sup>9</sup> The MSCI ESG Leaders index constituents are reviewed annually, which can result in the exclusion of some companies from the indexes or the inclusion of some previously excluded companies.

The risk-free rate of return, which accounts for a fund's willingness to hold cash during the sample period, is proxied by the monthly market yield on three-month US Treasury securities. The interest rate data are downloaded from the website of the Federal Reserve Bank of St. Louis.

As shown in Fig. 1, the number of funds flagged as ethical by Refinitiv Eikon during the sample period has increased considerably. Even though the number of both conventional and ethical funds increased, the increase in ethical funds is much higher. The cumulative growth rate in the number of funds during the sample period is 9.29 percent for conventional funds and 17.91 percent for ethical funds.

## 3. Preliminary analysis

Before we delve into Sharpe's (1992) return-based style analysis (RBSA), it is interesting to see whether differences in

<sup>6</sup> The "ethical" designation of the funds in the sample was downloaded from Refinitiv Eikon in May 2022. The "ethical flag" is not a variable that is available on a time-series basis.

<sup>7</sup> Because the methodology works with return series of the funds, one data point at the beginning of the sample period is lost. In addition, there is a missing data point in May 2004 for the MSCI US Small-Cap ESG Leaders and the MSCI US Mid- and Large-Cap ESG Leaders indexes. This gap is filled with linear interpolation.

<sup>8</sup> MSCI lists sin industries as those dealing in controversial weapons, nuclear weapons, civilian firearms, tobacco, alcohol, conventional weapons, gambling, nuclear power, fossil fuel extraction, and thermal coal power.

<sup>9</sup> [https://www.msci.com/eqb/methodology/meth\\_docs/MSCI\\_ESG\\_Leaders\\_Methodology\\_Nov2020.pdf](https://www.msci.com/eqb/methodology/meth_docs/MSCI_ESG_Leaders_Methodology_Nov2020.pdf), accessed October 1, 2022.

<sup>5</sup> For each fund family, only single-class funds are included, and duplicate-share classes are excluded, as suggested by Briere et al. (2017).

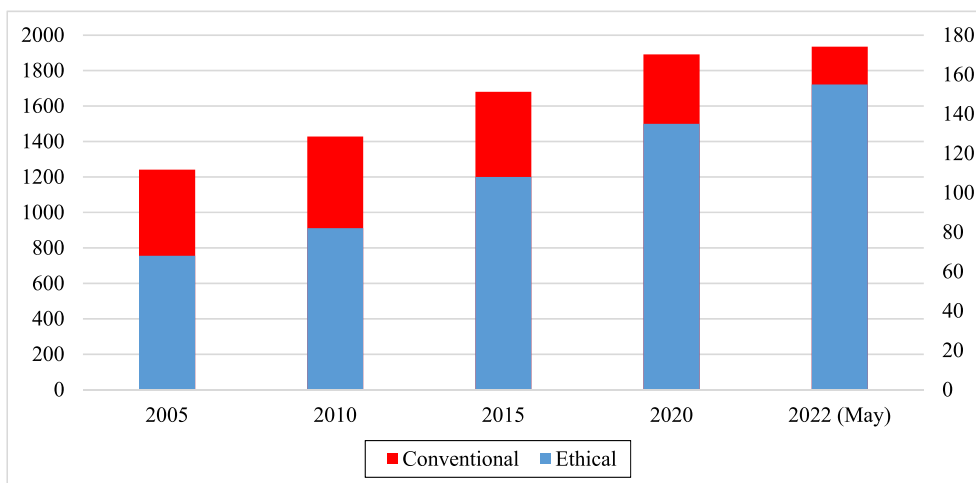


Fig. 1. Number of ethical and conventional funds during the sample period.

Notes: This figure presents the number of ethical and conventional funds at the end of each year during the sample period. The blue bars and the right axis (the red bars and the left axis) show the number of ethical (conventional) funds as of the end of a year.

the returns generated by each class of funds (ethical versus conventional) are useful for classifying the funds correctly. For this purpose, we use the distance metric suggested by Dor et al. (2006). Because the underlying assumption is that “conventional” and “ethical” funds adopt distinct investment styles by investing in assets with different degrees of ethical and social involvement, a difference in their returns should be observed. In the first step, the two investment styles are identified as ethical and conventional, and the returns for the ethical and conventional styles are calculated as the average of returns on all funds classified under either category. In the second step, correlations between the returns of each individual fund and the returns on each investment style (ethical versus conventional) are calculated. In the final step, these correlations are used to calculate the distance of a given fund from each investment style, as shown in the following equation:

$$D_{i,J}^T = (1 - \rho_{i,J}^T)^2 \tag{1}$$

In Equation (1),  $\rho_{i,J}^T$  is the correlation between the returns of fund  $i$  and strategy  $J$  (ethical versus conventional) over the prior  $T$  months, and  $D_{i,J}^T$  is the distance of fund  $i$  to investment strategy  $J$  (ethical versus conventional) over the prior  $T$  months.

When  $\rho_{i,J}^T$  equals 1,  $D_{i,J}^T$  equals 0, indicating the absence of any distance between fund  $i$  and investment style  $J$ . When  $\rho_{i,J}^T$  equals  $-1$ ,  $D_{i,J}^T$  equals 4, indicating the maximum possible distance between the fund and the investment style. Based on this distance metric, a fund is classified as ethical if its distance to the ethical style is smaller than its distance to the conventional style. A fund is “correctly classified” if both the Refinitiv Eikon ethical flag and the distance-based classification are ethical (conventional), implying that the fund’s returns are highly correlated with the returns of all other funds that are classified as being in the same category (ethical or conventional). The results of the correct classification of funds based on this metric are reported in Table 3, in which 56.3 percent of ethical and 56 percent of conventional funds are classified correctly. These values provide preliminary evidence that the publicly available fund classes might not represent the true investment styles of mutual funds because it seems that the distance between an individual ethical fund and all other ethical funds is not necessarily much smaller than the distance between an ethical fund and all conventional funds. Because the distances are so similar, it might not be easy to classify individual funds correctly as ethical or conventional.

Table 1  
Variable definitions.

Variable	Definition
<b>Panel A: Dependent Variable</b>	
Return	Rolling performance return of mutual funds downloaded from Refinitive Eikon. This performance measure incorporates capital gains and income yield from dividends or interest payments. It is measured on a rolling-period basis.
<b>Panel B: Asset Classes</b>	
ML-value	Return on MSCI US Mid- and Large-Cap Value Index
ML-growth	Return on MSCI US Mid- and Large-Cap Growth Index
ML-ESG	Return on MSCI US Mid- and Large-Cap ESG Leaders Index
S-value	Return on MSCI US Small-Cap Value Index
S-growth	Return on MSCI US Small-Cap Growth Index
S-ESG	Return on MSCI US Small Cap ESG Leaders Index
<b>Panel C: Control Variable</b>	
US 3 MTH	Market Yield on US Treasury Securities at a three-month constant maturity

Table 2  
Summary statistics for nonbinary variables used in the analyses.

Variable	Number of Obs.	Mean	Std. Dev.	Min	Max
Return (%)	381,282	0.9066	5.2208	-74.1703	65.5109
ML-value (%)	237	-0.0549	4.2276	-17.8368	12.1888
ML-growth (%)	237	0.6009	4.5505	-21.7737	17.6753
ML-ESG (%)	237	0.2042	4.3474	-13.8369	20.8491
S-ESG (%)	237	0.6797	5.5461	-18.6342	20.2236
S-growth (%)	237	0.5400	5.5991	-29.1181	15.2526
S-value (%)	237	-0.1618	5.5410	-46.0491	18.7958
Risk-free (US-3 mt) (%)	237	0.0973	0.1217	0.0010	0.4204

Notes: This table presents the summary statistics for nonbinary variables used in the analyses. Fund and index returns as well as the risk-free rate are reported on a monthly basis.

Table 3  
Distance metric.

	Ethical	Conventional	Total
<b>Ethical</b>	890 (56.3%)	692 (43.7%)	1582
<b>Conventional</b>	11,680 (44.0%)	14,840 (56.0%)	26,520

Notes: This table presents the percentage of correctly classified funds based on Dor et al.'s (2006) (DDG) distance metric. The DDG distance metric is based on the correlation  $\rho_{i,j}^T$  between the returns of fund  $i$  and investment style  $J$  and is calculated for 12-month non-overlapping periods as follows:  $D_{i,j}^T = (1 - \rho_{i,j}^T)^2$ . The return on investment style  $J$  is calculated as the average of returns on all funds in the sample following that investment style. Totals in the table represent the total fund-year instances that need to be classified as ethical or conventional, and the percentages represent the proportion of the totals that are classified as ethical or conventional.

#### 4. Methodology

In this study, Sharpe's (1992) return-based style analysis is used to examine the differences in the exposure of ethical and conventional mutual funds to different asset classes. The fund exposure to asset classes is estimated based on the following equation:

$$\tilde{R}_i = b_{i1}\tilde{F}_1 + b_{i2}\tilde{F}_2 + b_{i3}\tilde{F}_3 + \dots + b_{in}\tilde{F}_n + \tilde{e}_i \tag{2}$$

In Equation (2),  $\tilde{R}_i$  is the return on fund  $i$ , and  $\tilde{F}_n$  is the return on asset class  $n$ . As suggested by Sharpe (1992), in this model, coefficients ( $b_{in}$ ) are restricted to being positive and must add up to 1.<sup>10</sup> The list and description of asset classes used in this analysis are given in Table 1 and summary statistics are provided in Table 2. The model is estimated using quadratic programming.

In order to apply Sharpe's RBSA properly, it is necessary to use investment style factors that are mutually exclusive, exhaustive, and different from one another so that they represent the universe of assets available for investment. The factors in the model for differentiating the investment styles of ethical and

<sup>10</sup> Coefficients must add up to 1 because they represent the fund's budget allocation among different asset classes. Also, coefficients cannot be negative because mutual funds are prohibited from short selling.

Table 4  
Pearson correlation coefficients between original style factors.

	ML-value	ML-growth	ML_ESG	S-ESG	S-growth
ML-growth	0.85				
ML_ESG	0.94	0.96			
S-ESG	0.87	0.85	0.92		
S-growth	0.83	0.88	0.91	0.97	
S-value	0.89	0.80	0.90	0.97	0.93

Notes: This table presents the Pearson correlation coefficients between the returns on the original style factors (MSCI indexes) for the period August 2002 to May 2022. The returns are calculated as the log difference of the original series. All correlation coefficients are statistically significant at the 1% level.

conventional funds do not satisfy this requirement because both classes of funds can invest in small or large as well as growth or value stocks. The unique differentiating investment criterion should be ESG, which is expected to be used only by ethical funds. Table 4 reports the Pearson correlation coefficients between the investment style factors (returns of different asset classes) used in the analyses. The correlations are 0.8 or higher, indicating a lack of independence between the factors. This finding implies that before these factors can be used to estimate Sharpe's style regressions, they have to be orthogonalized in order to ascertain that they are completely independent of one another.

Different methods are available in the literature for orthogonalizing variables. The Fama and French (1993) and Gram-Schmidt algorithms (GS) (Paria, 2018) are two similar orthogonalization methods that are frequently used. Although these methods are straightforward to implement, the orthogonalized factors obtained from the GS orthogonalization are not unique because the method requires the identification of a lead factor and an ordering of the factors, and different leads and orderings generate different orthogonalized factors.

Correlations between the factors orthogonalized by using the GS method are reported in Panel A of Table 5.<sup>11</sup> Correlations between the orthogonalized factors are reduced significantly but they still do not equal zero. More importantly, correlations between the factors and their own orthogonalized values are not very high and even negative for four out of six factors (Panel B), implying that orthogonalization changes the original characteristics of the return series.

Klein and Chow (2013) introduce a robust methodology using the Schweinler-Wigner/Löwdin (Löwdin, 1970; Schweinler & Wigner, 1970) procedure to orthogonalize the factor returns. This method produces a democratic orthogonalization because it is not order dependent. The methodology extracts the uncorrelated components of each factor by removing the correlation between factors while preserving their original variance structure. Hence, the orthogonalized factors maintain the same variance as the originals, but the cross-sectional correlations between these factors are reduced to zero.

The correlations between the factors orthogonalized by using the Klein-Chow method are reported in Panel A of Table 6. The correlations between the orthogonalized factors

<sup>11</sup> The order of the style factors for the Gram-Schmidt orthogonalization is as follows: ML-ESG, S-ESG, ML-growth, S-growth, ML-value, and S-value.

Table 5  
Pearson correlation coefficients between style factors using the Gram-Schmidt (GS) orthogonalization method.

Panel A: Correlation between the style factors orthogonalized using the GS orthogonalization						
	ML-value	ML-growth	ML_ESG	S-ESG	S-growth	S-value
ML-value	1.00					
ML-growth	0.25	1.00				
ML_ESG	0.26	0.33	1.00			
S-ESG	0.25	0.27	0.45	1.00		
S-growth	0.34	0.31	0.30	0.39	1.00	
S-value	0.32	0.40	0.30	0.50	0.30	1.00

Panel B: Correlation between the original style factors and their GS-orthogonalized values						
Gram-Schmidt	Original					
	ML-value	ML-growth	ML_ESG	S-ESG	S-growth	S-value
ML-value	-0.30	0.04	-0.86	-0.24	-0.12	-0.05
ML-growth	-0.05	-0.34	-0.87	-0.16	-0.05	-0.08
ML_ESG	-0.05	-0.11	-0.91	-0.23	-0.06	-0.06
S-ESG	0.02	-0.03	-0.81	-0.47	-0.01	-0.07
S-growth	0.02	-0.14	-0.80	-0.42	0.14	-0.11
S-value	-0.06	0.04	-0.79	-0.47	-0.06	0.06

Notes: This table presents the Pearson correlation coefficients between the returns on style factors (MSCI indexes) that are orthogonalized using the Gram-Schmidt orthogonalization method for the period August 2002 to May 2022. The returns are calculated as the log difference of the original series. Panel A reports the Pearson correlation coefficients between the orthogonalized style factors. Panel B reports the Pearson correlation coefficients between the original style factors and their orthogonalized values.

Table 6  
Pearson correlation coefficients between style factors using Klein and Chow (2013) (KC) democratic orthogonalization method.

Panel A: Correlation between the style factors orthogonalized using the KC orthogonalization						
	ML-value	ML-growth	ML_ESG	S-ESG	S-growth	S-value
ML-value	1					
ML-growth	0	1				
ML_ESG	0	0	1			
S-ESG	0	0	0	1		
S-growth	0	0	0	0	1	
S-value	0	0	0	0	0	1

Panel B – Correlation between the original style factors and their KC orthogonalized values						
Democratic	Original					
	ML-value	ML-growth	ML_ESG	S-ESG	S-growth	S-value
ML-value	0.64	0.29	0.39	0.33	0.28	0.41
ML-growth	0.27	0.66	0.41	0.31	0.40	0.25
ML_ESG	0.38	0.43	0.52	0.38	0.37	0.35
S-ESG	0.25	0.26	0.30	0.59	0.46	0.47
S-growth	0.21	0.32	0.29	0.46	0.64	0.39
S-value	0.31	0.21	0.27	0.47	0.39	0.64

Notes: This table presents the Pearson correlation coefficients between the returns on style factors (MSCI indexes) that are orthogonalized using Klein and Chow's (2013) democratic orthogonalization method for the period August 2002 to May 2022. The returns are calculated as the log difference of the original series. Panel A reports the Pearson correlation coefficients between the orthogonalized style factors. Panel B reports the Pearson correlation coefficients between the original style factors and their orthogonalized values.

Table 7  
Descriptive statistics.

	ML-value	ML-growth	ML_ESG	S-ESG	S-growth	S-value
<b>Panel A: Original style factors</b>						
Mean	0.00	0.01	0.00	0.01	0.01	0.00
Standard Deviation	0.04	0.05	0.04	0.06	0.06	0.06
Kurtosis	2.12	2.74	2.96	1.01	3.44	20.07
Skewness	-0.39	-0.08	0.72	-0.06	-1.01	-1.98
<b>Panel B: Orthogonalized style factors using Gram-Schmidt method</b>						
Mean	0.01	0.00	-0.01	0.00	0.00	0.00
Standard Deviation	0.08	0.08	0.08	0.08	0.09	0.09
Kurtosis	15.73	22.69	25.63	32.39	31.35	29.67
Skewness	2.12	2.80	3.29	3.71	2.94	3.00
<b>Panel C: Orthogonalized style factors using Klein-Chow democratic orthogonalization method</b>						
Mean	0.00	0.01	0.01	0.01	0.01	0.01
Standard Deviation	0.04	0.05	0.04	0.06	0.06	0.06
Kurtosis	2.57	1.93	2.32	3.05	2.50	5.93
Skewness	-0.94	-0.75	-0.82	-0.91	-0.88	-1.23

Notes: This table reports the descriptive statistics for returns on the style factors (MSCI indexes) for the period August 2002 to May 2022. The returns are calculated as the log difference of the series. Panel A presents the descriptive statistics for the original style factors. Panels B and C report the descriptive statistics for the style factors orthogonalized using the Gram-Schmidt and Klein and Chow (2013) methods, respectively.

are all zero. Furthermore, the correlations between the original factors and their own orthogonalized values are 0.52 or higher and all positive (Panel B), indicating that factors preserve their characteristics after orthogonalization.

Panels A, B, and C of Table 7 present the mean, standard deviation, kurtosis, and skewness measures for the original, GS, and Klein-Chow orthogonalized factors, respectively. The values for the original (Panel A) and the Klein-Chow orthogonalized (Panel C) factors are similar whereas they are significantly different between the original (Panel A) and the GS orthogonalized (Panel B) factors. As intended, the standard deviations of the factors orthogonalized using the Klein-Chow method equal the standard deviations of their original counterparts. Even though the higher moments of the original and orthogonalized factors are slightly different, Klein and Chow (2013) conclude that the effectiveness of the orthogonalized factors is the same as that of the original factors. Because democratic orthogonalization removes the correlation between factors without significantly changing their distributional characteristics, factors orthogonalized with the Klein-Chow method are used in the following analyses.

### 5. Empirical findings

Sharpe's RBSA model is estimated for each of the individual funds separately, conditional on having at least 36 observations. The coefficient estimates from the RBSA model represent a fund's portfolio allocations (weights) to each of the Klein-Chow orthogonalized style factors. Because the sample comprises more than 2000 funds, it is impossible to report the results for each fund separately. Instead, Panel A of Table 8 presents the simple averages of portfolio allocations for the ethical and conventional classes as well as the difference in the

Table 8  
Average portfolio allocations (weights) to style factors.

	Conventional	Ethical	Difference Ethical – Conventional
<b>Panel A: Full Sample</b>			
ML-value	12.49%	11.41%	–1.08%
ML-growth	16.03%	19.98%	3.94%***
ML_ESG	10.53%	12.54%	2.01%***
S-ESG	14.75%	12.43%	–2.32%***
S-growth	23.38%	23.68%	0.29%
S-value	22.64%	19.97%	–2.67%***
<b>Panel B: 2002–2006</b>			
ML-value	17.28%	17.02%	–0.26%
ML-growth	4.23%	5.83%	1.60%
ML_ESG	26.54%	26.94%	0.39%
S-ESG	22.78%	21.08%	–1.70%
S-growth	21.91%	23.49%	1.59%
S-value	7.23%	5.64%	–1.59%
<b>Panel C: 2007–2011</b>			
ML-value	12.31%	11.84%	–0.47%
ML-growth	2.41%	2.67%	0.26%
ML_ESG	11.39%	13.00%	1.62%
S-ESG	21.84%	21.44%	–0.40%
S-growth	31.48%	31.19%	–0.29%
S-value	20.54%	19.26%	–1.28%
<b>Panel D: 2012–2016</b>			
ML-value	14.04%	11.97%	–2.07%
ML-growth	19.42%	22.01%	2.59%
ML_ESG	11.28%	13.98%	2.71%***
S-ESG	13.13%	13.33%	0.20%
S-growth	29.56%	29.70%	0.15%
S-value	12.47%	8.99%	–3.47%***
<b>Panel E: 2017–2022</b>			
ML-value	23.07%	22.91%	–0.16%
ML-growth	19.83%	22.86%	3.03%***
ML_ESG	5.93%	8.41%	2.48%***
S-ESG	2.03%	1.50%	–0.53%
S-growth	16.25%	16.71%	0.45%
S-value	32.70%	27.61%	–5.09%***

Notes: Sharpe's (1992) model is estimated for each fund using overlapping 60-month windows. The means for the estimated factor loadings for the conventional and ethical classes are calculated separately. The differences between the means are tested by using MANOVA. \*\*\* significant at the 1% alpha level.

allocations for the full sample period. The statistical significance of the difference in portfolio allocations of ethical versus conventional funds is tested using the multivariate analysis of variance (MANOVA) method. Fig. 2 illustrates the average weights for the full sample period. The averages of portfolio allocations for ethical and conventional funds and the difference in their allocations for the subperiods 2002–2006, 2007–2011, 2012–2016, and 2017–2022 are reported in Panels B, C, D, and E of Table 8, respectively.<sup>12</sup>

<sup>12</sup> As Starks (2021) argues, the market's awareness of ethical and social issues as well as the market presence of "socially responsible" or "ethical" investments increased over the past two decades. As a result, it is a useful exercise to explore whether the distinction between ethical and conventional fund styles may have changed over time. For this purpose, the sample is split into five-year subperiods. Subperiod analyses are repeated for three- and ten-year breakdowns. The results are qualitatively the same as before and are available from the authors upon request.

The main style factors of interest in this analysis are the ML-ESG and S-ESG, and ethical funds are expected to allocate significantly more to these style factors. When the allocations are examined for the full sample period, even though ethical funds allocate significantly more to ML-ESG, they allocate significantly less to S-ESG, indicating that ethical funds follow a size-based ESG strategy at best, and prefer to stay away from small capitalization stocks.

When the same comparisons are repeated for subperiods, during the first half of the sample period, no significant differences are found in portfolio allocations of ethical and conventional funds. This observation implies that the two fund classes follow essentially the same investment strategy, and ethical funds do not seem to give any priority to the ESG criterion in the earlier years. However, in the second half of the sample period, compared to conventional funds, ethical funds start to invest significantly more in the ML-ESG and ML-growth style factors and less in the S-value style factor. Furthermore, contrary to our a priori expectations, allocations of ethical funds to ML-ESG and S-ESG decline significantly over time. In fact, during the second half of the sample period, ethical and conventional funds both allocate less to ML-ESG and S-ESG even though allocations are significantly larger for ethical funds than conventional funds. Given the increased awareness and concern about environmental, social, and governance issues in recent years (Kachaner et al., 2020), the decline in the allocation of ethical funds to ML-ESG and S-ESG is quite puzzling.

Two additional analyses are performed using the portfolio allocation of individual funds to style factors. First, discriminant analysis is used to distinguish between ethical and conventional funds based on their allocation to different investment styles. Fig. 3 shows the plot of the percentage of ethical and conventional funds that are correctly identified by the discriminant analysis. In the early part of the sample period, it is easier to correctly identify conventional funds based on their allocation to style factors. In other words, the allocation of conventional funds to asset classes is markedly different from that of ethical funds in the earlier years. However, in the latter part of the sample period, the accuracy of the identification of ethical and conventional funds seems to become more similar. The percentage of ethical and conventional funds that are correctly identified by the discriminant analysis is at most 75 percent. On average, 64 percent of conventional and 56 percent of ethical funds are correctly identified. These findings imply that the portfolio allocation of conventional versus ethical funds might not be distinct enough to identify their investment styles accurately and consistently.

Second, the style consistency measure suggested by Chan, Chen, and Lakonishok (2002) is calculated to determine whether the investment styles followed by ethical and conventional funds are consistent over time. In order to calculate this measure, first, in each calendar year, the prior three years of returns on a fund are used to estimate the style regressions, and the fund's coefficient estimates (factor loadings) for each of the asset classes on the right-hand-side of the style regressions are collected. Next, these estimations are repeated over three-year rolling windows, and funds are ranked based on their allocations to a style (their factor loadings) over each window. In

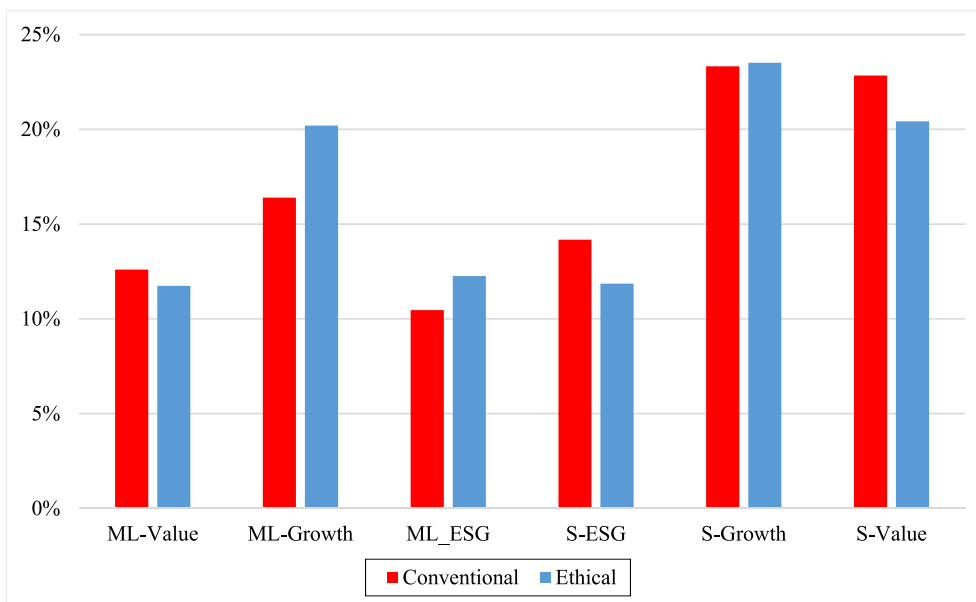


Fig. 2. Average portfolio allocations to style factors by ethical and conventional funds.  
 Notes: This figure presents the average portfolio allocations to style factors by conventional and ethical funds for the whole sample period.

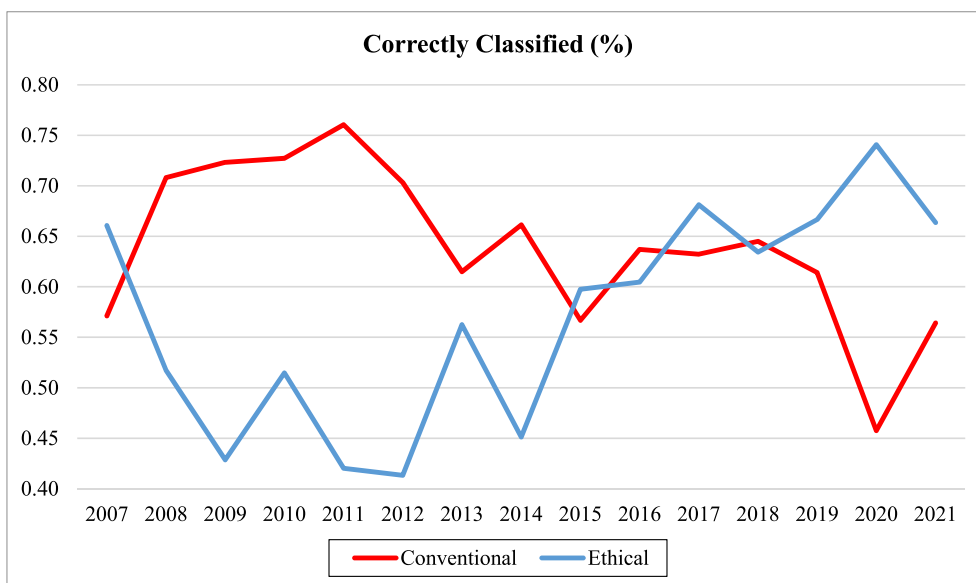


Fig. 3. Correctly classified ethical and conventional funds based on discriminant analysis.  
 Notes: This figure presents the percentage of ethical and conventional funds that are correctly identified as ethical and conventional based on a discriminant analysis using their portfolio allocations to different style factors.

the second step, for each fund, the serial correlation between its style allocation rankings in two consecutive, non-overlapping three-year windows is calculated. Higher correlations imply that the fund follows a consistent investment style over time because it means that the fund allocates similar percentages of its portfolio to certain asset classes over time. Table 9 reports the correlation coefficients for all funds and ethical and conventional funds separately.

The results reported in Table 9 suggest low consistency in the ESG investment strategies of both ethical and conventional funds. Instead, both classes of funds seem to follow ML-value and S-growth strategies more consistently. When the results

reported in Table 9 are evaluated together with those in Table 8, both ethical and conventional funds consistently allocate more to ML-value and S-growth investment styles. Furthermore, the results in Table 9 do not indicate a notable difference in the style consistency of the two fund classes.

**6. Robustness check**

As a robustness check, the model from the Sharpe framework is estimated as a panel without any restrictions on factor coefficients. In this setting, in order to determine whether the weight allocations of ethical and conventional funds are



Table 9  
Style consistency.

	ML-value	ML-growth	ML-ESG	S-ESG	S-growth	S-value
All Funds	0.689***	0.541***	0.380***	0.484***	0.722***	0.562***
Ethical Funds	0.639***	0.412***	0.330***	0.396***	0.688***	0.496***
Conventional Funds	0.691***	0.546***	0.380***	0.488***	0.724***	0.564***

Notes: This table reports the consistency in investment styles for all funds together as well as the ethical and conventional fund classes separately. Consistency in the investment styles of funds is measured by the correlation between rankings of fund factor loadings in two consecutive non-overlapping 36-month periods, following Chan, Chen, and Lakonishok (2002). \*\*\* significant at the 1% alpha level.

Table 10  
Panel regressions with time and fund fixed effects.

Variables	Panel A: Full Sample			Panel B: 2002–2006			Panel C: 2007–2011		
	Conventional	Ethical	Ethical – Conventional	Conventional	Ethical	Ethical – Conventional	Conventional	Ethical	Ethical – Conventional
ML-Value	0.38425*** (0.00320)	0.35839*** (0.00000)	−0.02586*** (0.00920)	0.37248*** (0.00440)	0.32972*** (0.00000)	−0.04276*** (0.01581)	0.36348*** (0.00334)	0.33362*** (0.00000)	−0.02986*** (0.00952)
ML-Growth	0.37751*** (0.00344)	0.39406*** (0.00000)	0.01655* (0.00929)	0.36718*** (0.00643)	0.37821*** (0.00000)	0.01103 (0.01933)	0.39810*** (0.00417)	0.40003*** (0.00000)	0.00193 (0.01291)
ML-ESG	0.38632*** (0.00241)	0.39350*** (0.00000)	0.00718 (0.00612)	0.37009*** (0.00510)	0.34409*** (0.00000)	−0.02600* (0.01407)	0.36662*** (0.00295)	0.35587*** (0.00000)	−0.01075 (0.01035)
S-ESG	0.34796*** (0.00287)	0.32638*** (0.00000)	−0.02158** (0.00871)	0.37073*** (0.00336)	0.33164*** (0.00000)	−0.03909*** (0.01011)	0.33617*** (0.00304)	0.32142*** (0.00000)	−0.01475 (0.00992)
S-Growth	0.39819*** (0.00341)	0.38414*** (0.00000)	−0.01405 (0.01096)	0.42793*** (0.00577)	0.39936*** (0.00000)	−0.02857* (0.01568)	0.41001*** (0.00390)	0.39218*** (0.00000)	−0.01783 (0.01166)
S-Value	0.35988*** (0.00339)	0.31265*** (0.00000)	−0.04723*** (0.00955)	0.38490*** (0.00513)	0.33043*** (0.00000)	−0.05447*** (0.01748)	0.36431*** (0.00497)	0.33321*** (0.00000)	−0.03110* (0.01727)
Constant	0.00319*** (0.00012)			−0.00426*** (0.00053)			0.00453*** (0.00019)		
Year/Fund FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Variables	Panel D: 2012–2016			Panel E: 2017–2022		
	Conventional	Ethical	Ethical – Conventional	Conventional	Ethical	Ethical – Conventional
ML-Value	0.36674*** (0.00395)	0.32618*** (0.00000)	−0.04056*** (0.01161)	0.42669*** (0.00371)	0.39907*** (0.00000)	−0.02762** (0.01084)
ML-Growth	0.40602*** (0.00456)	0.42681*** (0.00000)	0.02079 (0.01334)	0.37579*** (0.00338)	0.39525*** (0.00000)	0.01946** (0.00947)
ML-ESG	0.40233*** (0.00285)	0.42251*** (0.00000)	0.02018** (0.00895)	0.38133*** (0.00197)	0.41538*** (0.00000)	0.03405*** (0.00560)
S-ESG	0.36099*** (0.00550)	0.36792*** (0.00000)	0.00693 (0.01539)	0.34175*** (0.00311)	0.34080*** (0.00000)	−0.00095 (0.00935)
S-Growth	0.39547*** (0.00400)	0.38860*** (0.00000)	−0.00687 (0.01481)	0.37463*** (0.00366)	0.37101*** (0.00000)	−0.00362 (0.01279)
S-Value	0.35459*** (0.00451)	0.30159*** (0.00000)	−0.05300*** (0.01304)	0.36048*** (0.00363)	0.30818*** (0.00000)	−0.05230*** (0.00923)
Constant	0.00154*** (0.00018)			0.00242*** (0.00019)		
Year/Fund FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Control	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the estimation results for the panel regressions specified in Equation (3). Variable definitions are given in Table 1. The dependent variable of the panel models in this table is fund returns (Return). The control variable is the risk-free rate. Estimation results for the full sample are reported in Panel A. In Panels B through E, estimation results for non-overlapping subperiods are shown. All models are estimated by using robust standard errors clustered at the fund level to control for heteroskedasticity. \*, \*\*, and \*\*\* significant at alpha levels of 10%, 5%, and 1%, respectively. Robust standard errors are in parentheses.

different from each other, an ethical dummy variable is created, which takes a value of 1 for funds labeled as ethical by Refinitiv Eikon, and 0 otherwise. Interactive dummy variables are created by multiplying this variable by the orthogonalized style factor returns and the risk-free rate.<sup>13</sup>

$$\begin{aligned}
 Return_{it} = & \alpha_0 + \alpha_1 MLValue_t + \alpha_2 MLGrowth_t + \alpha_3 MLESG_t \\
 & + \alpha_4 SValue_t + \alpha_5 SGrowth_t + \alpha_6 SESG_t + \alpha_7 RF_t \\
 & + \sum_{j=1}^7 \beta_j Ethical_i \times (MLValue_t + MLGrowth_t \\
 & + MLESG_t + SValue_t + SGrowth_t + SESG_t + RF_t + u_{it}
 \end{aligned} \tag{3}$$

<sup>13</sup> The definitions of all other variables in Equation (3) are in Table 1.

Since time and fund fixed effects are included in the model, the ethical dummy variable is dropped from the model because of multicollinearity. This panel regression allows for different allocations to style factors by ethical and conventional funds. The panel regressions are estimated for the full sample period and for the 2002–2006, 2007–2011, 2012–2016, and 2017–2022 subperiods.<sup>14</sup> The results of these estimations are reported in Panels A, B, C, D, and E of Table 10.

For the full sample period, ethical funds allocate less to ML-value, S-ESG, and S-value and more to ML-growth style factors. Lower investment in S-ESG and S-value and higher investment in ML-growth by ethical funds are consistent with our earlier findings with Sharpe's RBSA. However, the allocations of ethical and conventional funds to the ML-ESG style factor show no difference. This finding is not consistent with the individual fund RBSA results. Furthermore, ethical funds seem to avoid small-cap strategies, and this is observed in both Sharpe's RBSA and panel regression results. Ethical funds consistently invest significantly less in at least one of the small-cap style factors in all periods. Surprisingly, ethical funds' preference for ML-ESG is evident only in the second half of the sample period. Allocations of ethical and conventional funds to the S-ESG style do not differ significantly, except in the 2002–2006 subperiod, in which ethical funds allocate significantly less to both the S-ESG and ML-ESG style factors than conventional funds. This is contrary to our findings with Sharpe's RBSA for that subperiod and signifies the importance of the constraints placed on weight allocations.

## 7. Conclusion

The common understanding in financial markets is that mutual funds that have similar stated investment objectives should also have similar investment styles (Kim et al., 2000). Until recently, most of the investment style discussions centered on determining whether mutual funds select investments that are in line with their profit objectives. With the increased popularity of socially responsible investing over the past decade or so, the debate over fund styles became more complex. When a fund is self-reported or designated by a third party as ethical, the expectation in the market is that this fund pursues an investment style in line not only with the profit but also the ESG objectives that are explicitly or implicitly adopted in the fund's publicly available prospectus and other information outlets. Because ethical mutual funds adopt the blended-value objective of generating financial and social returns simultaneously, it has become harder for investors to distinguish these funds from others that are purely profit oriented. In such an environment, the question of whether fund investors and managers truly understand what it means to form and maintain ethical portfolios is a relevant one to pose. If the answer to this question is uncertain, then it is implied that

ethical fund investors can face an agency conflict when they select funds based on ambiguous investment mandates that fund managers cannot clearly define or follow.

This study adopts Sharpe's style analysis methodology to understand whether a clear distinction exists in investment styles of conventional and ethical funds. The a priori expectation is to find that ethical funds emphasize the ESG-related criteria in their portfolio allocations in a manner that is decidedly different from that of conventional funds. Our empirical findings suggest that in the first half of the sample period, it is much more difficult to distinguish the investment styles of ethical and conventional funds. In other words, the potential for ethical fund investors to face the agency conflict of investing in portfolios that are not necessarily in line with their ESG-based preferences is higher in the earlier years. In the second half of the sample period, ethical funds appear to invest in large stocks with a higher ESG rating more than their conventional counterparts. Therefore, the two fund classes seem to have slightly more distinct investment styles in more recent years, even though they both decrease their allocation to ESG-based investment alternatives.

In this study, the different asset classes available to ethical and conventional fund managers are represented by MSCI's relevant return indexes. This might inherently limit the extent to which the two types of funds deviate from each other in their investment styles because the MSCI indexes are based on portfolios that might cover overlapping sets of stocks. For instance, the MSCI US Mid- and Large-Cap Value and MSCI US Mid- and Large-Cap ESG Leaders indexes are likely to include some of the largest companies, which also happen to have a high ESG rating. Also, during the earlier part of the sample period, the number of firms with an ESG rating is relatively low, and it was mostly the largest companies that received a rating.<sup>15</sup> However, this overlap does not influence the econometric results in the study because all return series are orthogonalized before they are used in the estimations.

The study's findings suggest that just because a fund is designated as ethical does not automatically ensure that the fund's investment style will predominantly emphasize the ESG-related concerns of its investors. On the contrary, there may be a cost to pay when you invest in an ethical fund because the fund's overall ESG profile as well as its financial returns might turn out to be lower than those of its conventional counterparts (Gangi & Varrone, 2018). As Starks (2021) argues, investors nowadays demand more information about the ESG activities of firms, and companies seem to abide by these demands as indicated by the fact that, for instance, in 2019, 90 percent of the S&P 500 firms issued sustainability reports. The results of the study imply that the ability to distinguish ethical from conventional funds might be enhanced by regulations that encourage or even force companies to disclose their ESG-related activities in a more formal and standardized manner.

<sup>14</sup> Subperiod analyses are repeated for three- and ten-year breakdowns. The results are qualitatively the same and are available from the authors upon request.

<sup>15</sup> <https://www.refinitiv.com/en/sustainable-finance/esg-scores#global-coverage/>, accessed October 1, 2022.

## References

- Allen, F. (2001). Presidential address: Do financial institutions matter? *The Journal of Finance*, 56(4), 1165–1175. <https://doi.org/10.1111/0022-1082.00361>
- Bams, D., Otten, R., & Ramezanifar, E. (2017). *Investment style Misclassification and mutual fund performance*. 28<sup>th</sup> Australasian finance and banking conference (Sydney, Australia).
- Barnett, M. L., & Salomon, R. M. (2012). Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. *Strategic Management Journal*, 33(11), 1304–1320. <https://doi.org/10.1002/smj.1980>
- Bauer, R., Koedijk, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. *Journal of Banking & Finance*, 29(7), 1751–1767. <https://doi.org/10.1016/j.jbankfin.2004.06.035>
- Briere, M., Peillex, J., & Ureche-Rangau, L. (2017). Do social responsibility screens matter when assessing mutual fund performance? *Financial Analysts Journal*, 73(3), 53–66.
- Brown, S. J., & Goetzmann, W. N. (1997). Mutual fund styles. *Journal of Financial Economics*, 43(3), 373–399. [https://doi.org/10.1016/S0304-405X\(96\)00898-7](https://doi.org/10.1016/S0304-405X(96)00898-7)
- Brown, K. C., Harlow, W. V., & Zhang, H. (2015). *Investment style volatility and mutual fund performance*. University of Texas at Austin.
- Chan, L. K. C., Chen, H.-L., & Lakonishok, J. (2002a). On mutual fund investment styles. *Review of Financial Studies*, 15(5), 1407. <https://doi.org/10.1093/rfs/15.5.1407>
- Chan, L. K. C., Hsiu-Lang, C., & Lakonishok, J. (2002b). On mutual fund investment styles. *Review of Financial Studies*, 15(5), 1407. <https://doi.org/10.1093/rfs/15.5.1407>
- Chen, H., Cohen, L., & Gurun, U. G. (2021). Don't take their word for it: The misclassification of bond mutual funds. *The Journal of Finance*, 76(4), 1699–1730. <https://doi.org/10.1111/jofi.13023>
- diBartolomeo, D., & Witkowski, E. (1997). Mutual fund misclassification: Evidence based on style analysis. *Financial Analysts Journal*, 53(5), 32–43. <https://doi.org/10.2469/faj.v53.n5.2115>
- Daniel, K., Grinblatt, M., Titman, S., & Wermers, R. (1997). Measuring mutual fund performance with characteristic-based benchmarks. *The Journal of Finance*, 52(3), 1035–1058. <https://doi.org/10.1111/j.1540-6261.1997.tb02724.x>
- Dor, A. B., Dynkin, L., & Gould, T. (2006). Style analysis and classification of hedge funds. *Journal of Alternative Investments*, 9(2), 10–29. <https://doi.org/10.3905/jai.2006.655934>
- Erragragui, E., & Lagoarde-Segot, T. (2016). Solving the SRI puzzle? A note on the mainstreaming of ethical investment. *Finance Research Letters*, 18, 32–42.
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3–56. [https://doi.org/10.1016/0304-405X\(93\)90023-5](https://doi.org/10.1016/0304-405X(93)90023-5)
- Gangi, F., & Varrone, N. (2018). Screening activities by socially responsible funds: A matter of agency? *Journal of Cleaner Production*, 197, 842–855.
- Holmström, B. (1979). Moral hazard and observability. *The Bell Journal of Economics*, 10(1), 74–91. <https://doi.org/10.2307/3003320>
- Kachaner, N., Nielsen, J., Portafaix, A., & Rodzko, F. (2020). *The pandemic is heightening environmental awareness*. <https://www.bcg.com/en-tr/publications/2020/pandemic-is-heightening-environmental-awareness>.
- Kim, M., Shukla, R., & Tomas, M. (2000). Mutual fund objective misclassification. *Journal of Economics and Business*, 52, 309–323.
- Klein, R. F., & Chow, V. K. (2013). Orthogonalized factors and systematic risk decomposition. *The Quarterly Review of Economics and Finance*, 53(2), 175–187. <https://doi.org/10.1016/j.qref.2013.02.003>
- Löwdin, P. O. (1970). On the nonorthogonality problem. *Advances in Quantum Chemistry*, 5, 185–199.
- Madhavan, A., Sobczyk, A., & Ang, A. (2021). Toward ESG alpha: Analyzing ESG Exposures through a factor lens. *Financial Analysts Journal*, 77(1), 69–88. <https://doi.org/10.1080/0015198X.2020.1816366>
- Parguel, B., Benoît-Moreau, F., & Larceneux, F. (2011). How sustainability ratings might deter 'greenwashing': A closer look at ethical corporate communication. *Journal of Business Ethics*, 102(1), 15–28. <https://doi.org/10.1007/s10551-011-0901-2>
- Paria, G. (2018). *Linear Algebra*. Calcutta, India: New Central Book Agency.
- Przychodzen, J., Gomez-Bezares, F., Przychodzen, W., & Larreina, M. (2016). ESG issues among fund managers-factors and motives. *Sustainability*, 8, 1078.
- Reddy, K., Mirza, N., Naqvi, B., & Fu, M. (2017). Comparative risk adjusted performance of Islamic, socially responsible and conventional funds: Evidence from United Kingdom. *Economic Modelling*, 66, 233–243. <https://doi.org/10.1016/j.econmod.2017.07.007>
- Renneboog, L., Ter Host, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32, 1723–1742.
- Schweinler, H. C., & Wigner, E. P. (1970). Orthogonalization methods. *Journal of Mathematical Physics*, 11, 1693.
- Sensoy, B. A. (2009). Performance evaluation and self-designated benchmark indexes in the mutual fund industry. *Journal of Financial Economics*, 92(1), 25–39. <https://doi.org/10.1016/j.jfineco.2008.02.011>
- Sharpe, W. F. (1992). Asset allocation: Management style and performance measurement. *Journal of Portfolio Management*, 18, 7–19.
- Starks, L. T. (2021). Environmental, social, and governance issues and the. *Financial Analysts Journal*. *Financial Analysts Journal*, 77(4), 5–21. <https://doi.org/10.1080/0015198X.2021.1947024>
- Swinkels, L., & Van Der Sluis, P. (2006). Return-based style analysis with time-varying exposures. *The European Journal of Finance*, 12(6/7), 529–552. <https://doi.org/10.1080/13518470500248508>
- Wermers, R. (2012). *A matter of style: The causes and consequences of style drift in institutional portfolios*. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2024259/](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2024259/).