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S.I.: RISKS RELATED TO ENVIRONMENTAL, SOCIAL AND GOVERNMENTAL ISSUES (ESG)

ESG as risk factor

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Abstract
There are numerous risk factors in asset pricing models that have been identified over the years. In this paper, we address the question of whether factors constructed using ESG (Environmental, Social, Governance) scores could potentially meet the necessary requirements for risk factors in multifactor models. While numerous studies indicate that the ESG performance of firms could be financially material, the integration of ESG factors has so far not been fully evaluated. We pay particular attention to the problem of divergent scores across different rating providers and investigate whether the regression results of 4- and 5-factor models converge. The evaluation is carried out with Fama–French and Carhart models, extended by an additional factor representing ESG, respectively. We find that there are ESG factors across all investigated rating providers that capture common-variation in stock returns over time, indicating that ESG should be considered in common asset pricing models.

Keywords ESG · Portfolio management · Risk factors · ESG integration

Introduction

The financial performance of investments meeting certain ESG (Environmental, Social, Governance) criteria in comparison with such that do not has been investigated in multiple contributions (e.g., Derwall et al. 2005; Humphrey et al. 2012). Although the findings seem to differ, Friede et al. (2015), Wallis and Klein (2015) as well as more recently, Atz et al. (2020) demonstrate that the bulk of research in that field indicates an at least nonnegative relation between the consideration of ESG criteria and financial performance. Deviations from this observation are mainly explained by three different approaches: the error-in-expectations hypothesis, the shunned-stock hypothesis and the environmental-risk hypothesis.

The error-in-expectations hypothesis is used to explain a possible outperformance of ESG investments compared to conventional investments. It suggests that ESG investments can deliver abnormal returns, because positive ESG information, in contrast to negative ESG information, is not fully or ambiguously priced by investors when it becomes public (e.g., Derwall et al. 2011; Capelle-Blancard & Petit 2019; Krüger 2015).

The shunned-stock hypothesis states that non-financial investor preferences lead firms with weaker ESG performances to earn abnormal returns (Hong & Kacperczyk 2009). Based on the work of Merton (1987) on segmented markets, it argues that the shunning of stocks/firms with weak ESG performances by norm-oriented investors leads to a systematic undervaluation and thus to higher risk-adjusted returns. Additionally, limited risk sharing among non-norm-oriented investors causes idiosyncratic risk and not just beta pricing to matter (Hong & Kacperczyk 2009).

Finally, the environmental-risk hypothesis regards firms' ESG performance as systematic risk for which investors demand compensation. The lower the ESG performance the higher the ESG risk of a firm (i.e., reputational or regulatory risk) and the higher the (expected) return. The non-consideration of ESG as systematic risk in standard asset-pricing models could therefore falsely lead to the indication of an

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outperformance of low-ESG stocks compared with high ESG-stocks. While some studies provide initial evidence that an ESG risk factor is able to explain returns on ESG investments, there has not yet been a study that systematically looks at the explanatory power of ESG risk factors.

This study addresses the latter of the underlying theories and asks whether there are risk factors related to ESG that should be incorporated into common asset-pricing models. Initially, we investigate this for the global market. In a robustness section, we check for such factors in other markets (i.e., North America and Europe). ESG-related risk factors are represented by classic zero-investment portfolios which might explain variation over time in stocks that are considered unsustainable (i.e., they have low ESG ratings) as well as such with high ESG ratings, which we refer to as sustainable here.

By implementing the above, we add to the numerous risk factors that have been identified over the past decades which seem to help explain the cross section of expected returns (e.g., Harvey et al. 2016; Cochrane 2011), although the way they are linked to economic fundamentals remains for the most part unclear.

Against this background we want to take up the objections made in connection with the "zoo of factors" (Cochrane 2011) with particular focus on too low significance levels leading to false positives (Harvey et al. 2016). Furthermore, we consider the requirements for robust factors by Beck et al. (2016), namely the grounding in a long and deep academic literature and the robustness across definitions. We address the robustness across definitions criteria by using ESG ratings of three different providers. We do so due to the findings of, e.g., Dorfleitner et al. (2015), Chatterji et al. (2016) and Berg et al. (2022) that ESG ratings differ. By constructing factors built upon three different raters, we hope to show that despite of the divergence between ESG raters, it is possible to construct risk factors on the basis of each of them, which explain common variation in returns of unsustainable and sustainable assets. If so, such factors could be used, e.g., in portfolio management to steer the risk with respect to ESG.

It is worth noting that the first requirement to risk factors made by Beck et al. (2016)—the grounding in a long and deep academic literature—is quite hard to account for in the context of ESG, since ESG considerations and the dissemination of rating data have unlike economic fundamental data been initiated as late as roughly two decades ago. From a theoretical standpoint, we argue that there is a sufficient amount of theory that suggests the existence of risk factors related to ESG. In fact, quite recently, Pástor et al. (2021) point out in an equilibrium model that from a perspective of risk, ESG stocks should yield lower returns in equilibrium due to their resilience to ESG-related shocks such as unexpected changes to climate change related regulation. This view is supported by Cornell (2020). Interestingly, it is argued that during transition periods when investor preferences are changing or when climate-related concerns increase, higher returns can be expected for sustainable assets since prices are driven upward (Pástor et al. 2021).

Given these arguments, factor premiums related to ESG could tend in either direction depending on how overall demand is shifting in favor of sustainable assets during a given timespan, therefore making it hard to derive a universally valid conclusion related to the direction of such a factor premium under the assumption of rational pricing. Pástor et al. (2021) recognize this fact and stress the difficulty of disentangling positive alphas owed to shifts in investors' tastes from alphas that are in fact due to some underlying risk component.

Consequently, any findings in this paper are more of a snapshot of how markets have valued ESG during a given timespan than they are predictive of the direction future valuations will take. To this end, one might raise the question as to whether a factor which may not be priced is useful at all. Pástor et al. (2022) show that changing concerns related to climate change explain the bad performance of value stocks in the post-2010s, leading to a negative premium of the HML factor of Fama and French (1993). As this factor was originally developed in a way such that its premium is positive, i.e., value stocks are expected to outperform growth stocks, it is possible that this premium reverses. Hence, we argue that for a given timespan, which is relatively short, a factor premium can average out to zero or can shift its direction, which is why we see the existence of a factor premium in the context of ESG as secondary.

To sum up, this paper joins the ranks of research related to the question of whether there are risk factors related to ESG that capture common variation in stock returns over time and which are consistent across definitions (i.e., across different rating providers). Initially, this is done for a global portfolio. In a robustness section, we extend the analysis to further markets to demonstrate factor robustness across different markets.

Similar research in that field was conducted by Lioui (2018) who finds that the average return of a factor which is long in stocks with low ESG strengths and short in such with high ESG concerns is significantly different from zero. Pollard and Sherwood (2018) show that ESG premia provide excess returns, Oestreich and Tsiakas (2015) along with Görgen et al. (2020) show that factors related to carbon risk explain common variation in stock returns over time. In a similar vein, Hsu et al. (2023) propose a risk factor that controls for environmental political uncertainty. Ciciretti et al. (2017) find further evidence for the existence of an ESG premium, Jin (2018) underscores these findings for the US market and Hübel and Scholz (2018) find increased

explanatory power for models extended by an additional factor proxy for ESG.

With our study, we contribute further important insights with respect to the relevance of such factors for common asset-pricing models. If there are systematic risk components related to ESG, we expect the produced loadings of ten decile portfolios built upon ESG data with ascending scores across deciles on our UMS (unsustainable minus sustainable) risk factor in time-series regressions to be positive (negative) for the lowest (highest) scores. For deciles that are somewhere in the middle between the lowest and highest deciles, we expect factor loadings on UMS that are rather insignificant since those deciles should be neither strongly influenced by negative shocks related to ESG risks nor should they be entirely unaffected. According to our knowledge, we are the first to consider ESG data by three different rating providers, different markets as well as several dimensions of ESG and therefore close an important research gap related to ESG and factor robustness in the sense of Beck et al. (2016).

We find that our factors capture common-variation in stock returns over time and enhance the explanatory power of common asset pricing models. This applies to factors built with rating data of three different providers, across all geographies as well as across all ESG dimensions. Consequently, we argue that ESG-related factors should be incorporated into common asset pricing models to manage the risk related to ESG.

The remainder of this paper proceeds as follows. Section "Data and methods" comprises the implementations regarding data and methods. Section "Results" provides descriptive statistics and the results of our regression analyses. Section "Robustness checks" provides robustness regression results for additional markets. Section "Conclusion" concludes.

Data and methods

Data collection and preparation

For our ESG risk factor in the time-series regression, we depend on firm-specific ESG ratings. We obtain ratings from ASSET4, LSE Refinitiv (henceforth Refinitiv) and Moody's Vigeo Eiris (henceforth Vigeo Eiris).

ASSET4 uses publicly available and traceable sources such as websites, SEC filings, sustainability reports, media sources, and NGO reports to derive more than 700 non-financial firm-level data points. Every data point is the firm-specific expression of a single ESG-related characteristic. These data points are aggregated in several stages into 18 categories that cover general ESG themes within the E, S, and G pillars. ASSET4 generates a rating for each category. A rating ranges from 0 to 100 points, where 100 indicates a very strong ESG performance relative to other firms in the firm universe. Moreover, to obtain a firm's overall ESG performance, we calculate ratings as equally weighted aggregation of the E, S, and G pillars (henceforth EWR).

Refinitiv provides data on companies' sector specific ESG performance based on reported data. Altogether, ESG performance is measured in 10 different main themes pertaining to distinct pillars of ESG, where—just as for ASSET4—scores range from 0 to 100 points with increasing ESG performance. The first ESG ratings by Refinitiv and ASSET4 can be obtained from 2002.

Vigeo Eiris ESG ratings measure the degree to which firms take into account and manage material ESG factors. Firms with higher ESG ratings are better at managing relationships with their stakeholders on a scale from 0 to 100. To generate ratings, Vigeo Eiris analyzes and scores up to 38 distinct ESG criteria that are framed within 40 industry specific models. In each industry framework, the 38 generic ESG criteria are assigned a weight that reflects the sector specific materiality of the analyzed criterion. Each criterion has a defined set of so-called Principles of Action. These determine the active content of the analysis and articulate the actions that Vigeo Eiris would expect a high-performing firm to undertake in this dimension. These principles are derived from universally recognized norms and standards emanating from organizations such as the United Nations, the International Labour Organization, and the Organisation for Economic Cooperation and Development. Within the rating process, qualitative and quantitative data, management and performance data as well as self-reported and third-party data are used. Vigeo Eiris offers ESG ratings for the E, S and G pillar as well as a general ESG assessment for an international sample of firms for a time series starting in 2003.

While these three rating providers calculate ESG ratings for the same ESG dimensions, i.e., the E, S, and G pillars as well as an aggregated ESG assessment, they differ in firm coverage. To ensure that potential deviations in factor loadings of the ESG risk factor for the respective rating provider do not arise due to different firm coverages but are attributable to the differences in rating methodologies, we run the regressions for each ESG rating provider based on the same set of firms. After constraining our firm sample to those firms that are contained in each initial set of the three agencies' firm universes, we pair ESG data with financial data from Refinitiv such that we end up with a universe of roughly 4500 companies.

Since Refinitiv ESG ratings measure a company's ESG performance relative to its industry, we recalculate the scores following the methodology of Dyck et al. (2019) to finally obtain ratings data relative to our entire matched equity universe. Furthermore, to adjust for gaps in the time-series of Vigeo Eiris ESG ratings, we perpetuate each score to two years in the future if there are no scores

available. This adjustment and the way it is set out is chosen to prevent our sample from becoming too small and to thus avoid inconclusive results due to idiosyncratic characteristics in our portfolios. To underpin this approach, we assume that a company's ESG score will not change too drastically from one year to another especially without the consideration of ESG controversies. With respect to ASSET4 ESG ratings, no further corrections are made.

Thereafter, ES (Environmental and Social) as well as ESG (Environmental, Social, Governance) scores are calculated by taking the arithmetic mean of the respective pillars such that we finally obtain five ESG indicators (Environmental, Social, Governance, ES and ESG) to measure a company's ESG performance.

We obtain financial data from Refinitiv. To calculate returns, we take the total return prices for each company to account for course movements due to dividend payouts and stock splits. Following Ince and Porter (2006), further adjustments are made either to the returns themselves or to the underlying total return prices to ensure high similarity to CRSP (Center of Research in Security Prices) return data. Therefore, we exclude all penny stocks (stocks with a price equal to or below 1$) to preclude erroneous return data due to rounding issues. Furthermore, we correct for returns above 300% which reverse within one month and dismiss those returns which are equal to 0 for more than two months in a row. Finally, we remove those returns which are not available throughout every month starting in July of every year t to June of t+1 to prevent our portfolio returns from artificial volatility due to missing data.

We drag market value data for every company contained in our matched universe at the end of June of every year t. This point in time is chosen in accordance with Fama and French's (1993) methodology to account for the fact that the required accounting data to construct their value factor must be available at the time when the regressions are conducted. Since data on companies' market value are available throughout the entire year, we obtain our respective data at the closest point in time with respect to our regressions.

The SMB (small minus big), HML (High minus low) and WML (winners minus losers) factors for the Fama–French three- and the Carhart four-factor models are drawn from Kenneth French's data library. We use the Fama–French developed factors for the regressions for our regressions with global portfolios. For the risk-free rates, we use one-month U.S. Treasury bills since this study is from the perspective of an U.S. investor.

To ensure broad portfolio diversification for the dependent as well as the independent returns our time-series for our regression for the global market starts in July 2007 and ends in June 2020. Accordingly, our time-series finally comprises 156 observations of monthly returns.

Variable construction

To construct our risk factor proxy related to ESG, we follow the methodologies of Fama and French (1993) and Görgen et al. (2020) and build value-weighted UMS (unsustainable minus sustainable) portfolios which are long in unsustainable and short in sustainable assets. We go long unsustainable stocks since those stocks' expected returns should be larger than those of the sustainable part (see, e.g., Pástor et al. (2021)) and we want to choose a setting in which positive factor premiums can at least be expected. To adjust for the evidence that firms with high market capitalizations tend to have higher ESG ratings (see, for example, Drempetic et al. (2020), Humphrey et al. (2012) or Brammer et al. (2006)), we take the market value of every firm in June of every year t and split the data at its median into a small firm sample (S) and one big firm sample (B). We then separately sort the same stocks according to their particular ESG score of every year t-2 and construct one unsustainable (L) and one sustainable (H) subset of stocks for every year t by taking the 30th and 70th percentile as thresholds, respectively. Like in Fama and French (1993), these thresholds have no deeper economic intuition and are chosen arbitrarily.

Thereafter, we match the resulting portfolios with those from the size splits. The lag in the ESG data of two years is used for the same reason as for which Fama and French (1993) lag their data with respect to their value factor, i.e., since rating providers need time to provide ESG ratings for a given year, a lag is introduced to ensure the availability of the ratings at the time of portfolio construction. Here, we take a conservative approach and assume that it takes more than six months until ESG ratings for a given year are made public. As robustness check, we also construct factors with ESG data of t-1. Finally, we build our UMS portfolio as the difference of the arithmetic means of S/L, B/L and S/H, B/H and calculate monthly returns for July of year t until June of t+1 after which the portfolios are reformed. This is done for every rating provider as well as for each ESG dimension leading to 5 x 3 different factor constructions.

Consistent with Fama and French (1993), our proxies for the market portfolios are value-weighted portfolios which comprise all stocks that are contained in our matched universe with respect to the relevant market. Thereafter, we calculate monthly excess returns by subtracting the respective proxy for our risk-free rate from our calculated market return.

Our dependent returns in the time-series regressions are excess returns of ten decile portfolios constructed with ascending ESG scores, whereby the first decile contains those stocks whose scores fall below the 10th percentile and so forth. The

decile portfolios are recalculated—just as it applies to the UMS portfolio allocations—by the end of June of every year t. Finally, we calculate monthly excess returns by subtracting our monthly data of our respective risk-free rate proxy from every monthly return observation of each decile portfolio. The next section initially presents our descriptive statistics related to our constructed variables, whereafter we present our results for the time-series regressions.

Results

Descriptive statistics

Descriptive statistics and factor correlations are presented in Tables 1 and 2 and present an overview of the variables used in our asset-pricing tests. The subsequent part of this section analyzes the magnitudes and significances of the variables for our investigated market.

Table 1 Summary statistics: world

	Mean	SD
Market	−0.002	0.052
SMB	−0.001	0.015
HML	−0.004**	0.020
WML	0.003	0.037
ASSET4		
UMS_{ENV}	0.002	0.013
UMS_{GOV}	−0.003	0.024
UMS_{SOC}	0.002	0.014
UMS_{ES}	0.002	0.014
UMS_{ESG}	0.001	0.017
Refinitiv		
UMS_{ENV}	0.001	0.014
UMS_{GOV}	−0.002	0.021
UMS_{SOC}	0.001	0.014
UMS_{ES}	0.002	0.014
UMS_{ESG}	0.001	0.015
Vigeo Eiris		
UMS_{ENV}	0.002	0.023
UMS_{GOV}	−0.0005	0.025
UMS_{SOC}	0.002	0.023
UMS_{ES}	0.001	0.022
UMS_{ESG}	−0.0003	0.021

This table shows means, standard deviations and significance levels for the independent variables in the time-series regressions for the global market

*, ** and *** denote significance levels for independent t-tests on the 10%, 5% and 1% levels, respectively

Table 2 Correlations

	Market	SMB	HML	WML
Market	1.000***	0.191**	0.186**	−0.420***
SMB	0.191**	1.000***	−0.032	−0.059
HML	0.186**	−0.032	1.000***	−0.436***
WML	−0.420***	−0.059	−0.436***	1.000***
ASSET4				
UMS_{ENV}	−0.068	0.180**	−0.459***	0.177**
UMS_{GOV}	−0.532***	−0.017	−0.237***	0.371***
UMS_{SOC}	−0.164**	0.225***	−0.590***	0.373***
UMS_{ES}	−0.156*	0.195**	−0.548***	0.329***
UMS_{ESG}	−0.464***	0.088	−0.558***	0.477***
Refinitiv				
UMS_{ENV}	−0.020	0.226***	−0.429***	0.071
UMS_{GOV}	−0.548***	−0.040	−0.276***	0.393***
UMS_{SOC}	−0.361***	0.118	−0.453***	0.479***
UMS_{ES}	−0.168**	0.240***	−0.499***	0.200***
UMS_{ESG}	−0.387***	0.142*	−0.541***	0.467***
Vigeo Eiris				
UMS_{ENV}	0.261***	0.266***	−0.261***	−0.095
UMS_{GOV}	−0.302***	−0.033	−0.212***	0.270***
UMS_{SOC}	0.016	0.232***	−0.405***	0.045
UMS_{ES}	0.190**	0.270***	−0.305***	−0.072
UMS_{ESG}	0.030	0.215***	−0.328***	−0.045

This table shows Pearson correlations of the independent variables in the time-series regressions for the global market

*, ** and *** denote significance levels on the 10%, 5% and 1% levels, respectively

Our generated factor premiums do all not significantly differ from zero, except for the premium generated by the HML factor. All other independent variable factor premiums are insignificant. Interestingly, the factor premiums of the Governance factor premium are negative in absolute magnitude across all three ratings providers, whereby all other premiums are positive with a few exceptions. While the premiums generated with ASSET4 and Refinitiv ESG data are about the same magnitude of standardized units away from a distribution with a mean of zero, premiums generated with Vigeo Eiris rating data are smaller in magnitude adjusted for standard deviations.

Although the obtained correlations depicted in Table 2 seem high in absolute magnitude and are highly significant on some occasions, we infer this circumstance to be negligible for two reasons.

First, the standard Fama–French or Carhart factors, respectively, are also highly correlated in terms of Pearson's r, second, because the correlations are all below 0.7, the critical value when it comes to detecting multicollinearity in regression models. For our sample period we conclude that our generated factor premiums are overall rather

Table 3 ASSET4 world: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	0.995***	1.049***	1.029***	1.031***	1.038***	1.054***	1.005***	0.961***	1.029***	0.978***
	(0.029)	(0.013)	(0.022)	(0.021)	(0.020)	(0.021)	(0.019)	(0.031)	(0.026)	(0.023)
SMB	−0.005	0.138***	0.047	0.180***	0.168***	0.095	0.008	−0.014	−0.126***	−0.251***
	(0.062)	(0.048)	(0.072)	(0.064)	(0.062)	(0.060)	(0.051)	(0.047)	(0.042)	(0.031)
HML	−0.021	−0.003	−0.025	−0.043	0.013	0.006	0.078*	0.184***	−0.055	0.106**
	(0.055)	(0.051)	(0.043)	(0.063)	(0.041)	(0.059)	(0.045)	(0.051)	(0.038)	(0.049)
WML	−0.003	−0.028	−0.071	−0.050	0.019	−0.076***	−0.037	0.089***	0.005	0.042***
	(0.033)	(0.020)	(0.046)	(0.033)	(0.022)	(0.023)	(0.023)	(0.031)	(0.019)	(0.013)
UMS	0.492***	0.565***	0.546***	0.113	0.240***	0.242***	0.171***	−0.113	−0.258***	−0.307***
	(0.082)	(0.081)	(0.071)	(0.074)	(0.056)	(0.085)	(0.065)	(0.073)	(0.049)	(0.048)
Constant	0.001	0.0005	−0.001	0.002*	−0.0002	−0.001*	−0.001	−0.001	−0.001	0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	292	286	289	288	289	289	288	289	289	288
Adjusted R^2	0.958***	0.966***	0.954***	0.964	0.972***	0.968***	0.977***	0.972**	0.977***	0.979***
Governance										
Market	0.938***	0.970***	1.012***	1.106***	1.156***	1.100***	1.045***	0.977***	0.977***	0.900***
	(0.027)	(0.023)	(0.032)	(0.021)	(0.029)	(0.018)	(0.043)	(0.018)	(0.019)	(0.031)
SMB	0.316***	0.232***	0.094*	0.081	0.005	−0.071	−0.011	−0.105	−0.129***	−0.218***
	(0.084)	(0.051)	(0.052)	(0.063)	(0.057)	(0.066)	(0.061)	(0.066)	(0.046)	(0.056)
HML	−0.125**	0.017	0.112***	0.001	−0.014	0.058*	0.066	0.167***	−0.014	0.056
	(0.054)	(0.035)	(0.038)	(0.042)	(0.058)	(0.035)	(0.078)	(0.038)	(0.062)	(0.047)
WML	−0.041	−0.040*	−0.010	−0.030	0.018	0.052***	−0.029	−0.018	0.008	0.082***
	(0.037)	(0.021)	(0.021)	(0.024)	(0.041)	(0.020)	(0.032)	(0.049)	(0.016)	(0.024)
UMS	0.531***	0.540***	0.386***	0.229***	0.142***	−0.032	−0.155**	−0.211***	−0.234***	−0.282***
	(0.082)	(0.042)	(0.061)	(0.065)	(0.052)	(0.047)	(0.065)	(0.046)	(0.031)	(0.032)
Constant	−0.001	−0.0004	−0.0002	−0.0004	0.001	−0.0002	−0.001	−0.001	−0.001	0.00004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	289	289	289	289	288	289	289	288	289
Adjusted R^2	0.921***	0.965***	0.956***	0.963***	0.969***	0.974	0.970***	0.969***	0.979***	0.969***
Social										
Market	0.986***	0.972***	1.097***	1.071***	1.090***	1.019***	1.021***	0.954***	0.995***	0.972***
	(0.025)	(0.016)	(0.021)	(0.025)	(0.036)	(0.022)	(0.031)	(0.014)	(0.023)	(0.022)
SMB	0.234***	0.095**	0.177***	0.113*	−0.018	0.121**	0.018	−0.039	−0.153***	−0.238***
	(0.063)	(0.045)	(0.059)	(0.065)	(0.072)	(0.061)	(0.062)	(0.041)	(0.056)	(0.047)
HML	−0.074	−0.037	−0.105	0.009	−0.132	0.088	0.230***	0.072	0.086**	0.040
	(0.054)	(0.052)	(0.088)	(0.072)	(0.098)	(0.063)	(0.079)	(0.051)	(0.040)	(0.063)
WML	−0.009	−0.034	−0.030	−0.002	−0.039	−0.048	0.048	0.008	0.016	0.041**
	(0.032)	(0.027)	(0.032)	(0.025)	(0.026)	(0.034)	(0.043)	(0.020)	(0.025)	(0.018)
UMS	0.360***	0.403***	0.301***	0.296***	0.275***	0.216***	0.202***	−0.070	−0.100	−0.448***
	(0.134)	(0.102)	(0.113)	(0.105)	(0.094)	(0.081)	(0.069)	(0.055)	(0.065)	(0.067)
Constant	0.0004	0.001*	0.001	0.001	−0.0003	0.001	−0.0001	0.0001	−0.002***	−0.0002
	(0.001)	(0.0005)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	289	288	289	289	288	289	289	289	289
Adjusted R^2	0.952***	0.967***	0.966***	0.961***	0.952***	0.965***	0.969***	0.976	0.978*	0.976***

Table 3 (continued)

Decile	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ES										
Market	0.988***	1.041***	1.022***	1.085***	1.041***	1.035***	1.065***	0.998***	0.946***	0.989***
	(0.030)	(0.025)	(0.016)	(0.024)	(0.023)	(0.027)	(0.030)	(0.020)	(0.015)	(0.022)
SMB	0.180***	0.132*	0.119***	0.199***	0.016	0.016	0.072	0.086	−0.163***	−0.261***
	(0.053)	(0.069)	(0.045)	(0.065)	(0.071)	(0.063)	(0.062)	(0.061)	(0.041)	(0.045)
HML	−0.052	−0.008	−0.063	−0.047	0.035	0.127	−0.010	0.200**	0.067	0.018
	(0.081)	(0.078)	(0.076)	(0.060)	(0.097)	(0.093)	(0.080)	(0.084)	(0.044)	(0.063)
WML	−0.018	0.008	−0.066*	0.014	−0.019	−0.045	−0.058**	0.034	0.041**	0.036**
	(0.029)	(0.025)	(0.035)	(0.029)	(0.038)	(0.033)	(0.023)	(0.024)	(0.018)	(0.015)
UMS	0.454***	0.468***	0.315***	0.281***	0.259***	0.224**	0.136	0.036	−0.181***	−0.404***
	(0.103)	(0.072)	(0.077)	(0.067)	(0.081)	(0.093)	(0.090)	(0.069)	(0.062)	(0.060)
Constant	0.001	0.001	0.001	0.001	0.0004	−0.001	−0.001	0.0002	−0.001*	−0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	289	288	289	289	289	288	288	289	289
Adjusted R^2	0.950***	0.971***	0.968***	0.964***	0.964***	0.962***	0.961*	0.971	0.981***	0.979***
ESG										
Market	0.956***	1.084***	1.051***	1.016***	1.087***	1.024***	0.936***	1.024***	1.053***	0.939***
	(0.036)	(0.026)	(0.038)	(0.022)	(0.042)	(0.025)	(0.018)	(0.027)	(0.024)	(0.024)
SMB	0.161***	0.231***	0.214***	0.153***	0.145*	0.078*	0.089**	0.069	−0.069	−0.325***
	(0.046)	(0.051)	(0.071)	(0.039)	(0.078)	(0.043)	(0.041)	(0.070)	(0.052)	(0.044)
HML	−0.110	−0.168***	0.022	−0.067**	−0.068	0.109**	0.019	0.058	0.069	0.084*
	(0.075)	(0.047)	(0.079)	(0.033)	(0.087)	(0.046)	(0.058)	(0.067)	(0.055)	(0.046)
WML	−0.039	−0.061***	−0.032	−0.012	−0.057**	−0.058***	−0.035	0.038	0.062**	0.049***
	(0.037)	(0.020)	(0.032)	(0.021)	(0.027)	(0.017)	(0.022)	(0.034)	(0.024)	(0.018)
UMS	0.484***	0.304***	0.223*	0.065	0.172	0.274***	−0.001	−0.110***	−0.238***	−0.230***
	(0.107)	(0.077)	(0.135)	(0.080)	(0.105)	(0.039)	(0.085)	(0.042)	(0.072)	(0.045)
Constant	−0.001	−0.0003	0.002**	0.001*	−0.001	−0.001*	−0.001	0.0002	−0.0003	−0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	289	289	289	289	288	289	289	288	289
Adjusted R^2	0.927***	0.967***	0.956***	0.961	0.954**	0.973***	0.965	0.970*	0.979***	0.980***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, adjusted R^2 indications are from *F*-tests for nested models. Newey–West standard errors are reported in parentheses

not priced, which in our opinion is however not of great concern, since the "standard" factors have themselves been not priced on average for the same time period.

Common variation over time

In this section, we describe the results obtained from our time-series regressions with respect to whether the constructed risk factors related to ESG capture common variation in returns over time for the global market. The interpretation of the results refers to those regressions conducted with UMS factors built upon ESG data of t-2. Regressions conducted with ESG factor construction based on data of t-1 for robustness reasons however lead to results congruent with our prior findings.[1] The time-series regression outputs can be found in Tables 3, 4 and 5, and our

[1] Due to space constraints we do only report the statistics for the Carhart + UMS regressions with ESG data as of t-2.The results of the regressions conducted with ESG data of t-1 as well as the results for the Fama–French + UMS regressions are available on request.

Table 4 Refinitiv world: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.039***	0.931***	0.737***	0.989***	1.072***	1.050***	0.987***	0.970***	0.978***	0.997***
	(0.023)	(0.058)	(0.143)	(0.065)	(0.029)	(0.028)	(0.035)	(0.023)	(0.019)	(0.022)
SMB	−0.022	0.314**	0.133	0.302**	0.171**	0.155***	0.141*	−0.056	−0.195***	−0.249***
	(0.064)	(0.123)	(0.169)	(0.128)	(0.077)	(0.048)	(0.073)	(0.052)	(0.039)	(0.041)
HML	−0.051	−0.008	0.252*	0.030	−0.041	−0.021	0.220***	0.029	0.059	0.094*
	(0.053)	(0.064)	(0.148)	(0.085)	(0.053)	(0.057)	(0.063)	(0.064)	(0.037)	(0.054)
WML	−0.051	−0.047	0.284***	−0.042	−0.004	−0.020	0.025	0.010	0.075***	0.010
	(0.032)	(0.067)	(0.088)	(0.065)	(0.026)	(0.026)	(0.035)	(0.025)	(0.021)	(0.022)
UMS	0.660***	0.176	0.383**	0.037	0.097	0.111	0.148*	−0.077	−0.156**	−0.227***
	(0.078)	(0.162)	(0.152)	(0.151)	(0.084)	(0.082)	(0.079)	(0.056)	(0.070)	(0.080)
Constant	0.001	0.0003	0.001	0.002*	0.00002	−0.001	−0.002**	0.0003	−0.001*	0.0001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	401	212	280	267	284	288	288	288	288	289
Adjusted R^2	0.965***	0.900*	0.682**	0.912	0.963	0.962	0.966**	0.971	0.973***	0.976***
Governance										
Market	0.933***	1.068***	1.089***	1.134***	1.034***	1.003***	1.010***	0.967***	0.989***	0.935***
	(0.032)	(0.024)	(0.015)	(0.042)	(0.025)	(0.021)	(0.024)	(0.021)	(0.034)	(0.020)
SMB	0.268***	0.181***	0.074	0.025	−0.066	−0.062	−0.026	−0.071	−0.224**	−0.118***
	(0.045)	(0.044)	(0.061)	(0.037)	(0.042)	(0.060)	(0.062)	(0.055)	(0.099)	(0.037)
HML	0.047	0.042	−0.025	−0.062	−0.003	0.120***	0.094*	0.064	−0.014	0.129***
	(0.048)	(0.036)	(0.039)	(0.044)	(0.034)	(0.046)	(0.053)	(0.065)	(0.080)	(0.037)
WML	−0.038	−0.016	−0.013	−0.047**	−0.001	0.013	0.026	−0.023	−0.042	0.109***
	(0.030)	(0.022)	(0.016)	(0.024)	(0.022)	(0.032)	(0.031)	(0.058)	(0.029)	(0.025)
UMS	0.653***	0.563***	0.412***	0.193***	0.042	−0.111*	−0.169***	−0.257***	−0.253***	−0.231***
	(0.058)	(0.045)	(0.069)	(0.041)	(0.059)	(0.057)	(0.033)	(0.038)	(0.049)	(0.032)
Constant	−0.0003	−0.001	0.0002	−0.0002	0.0001	0.0002	−0.001	−0.001	−0.0002	−0.0005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	291	286	288	288	288	288	288	289	288	289
Adjusted R^2	0.944***	0.971***	0.965***	0.975***	0.974	0.972***	0.974***	0.966***	0.959***	0.977***
Social										
Market	0.907***	1.013***	1.104***	1.077***	1.032***	1.047***	1.050***	0.981***	1.022***	0.958***
	(0.038)	(0.018)	(0.034)	(0.025)	(0.023)	(0.021)	(0.030)	(0.033)	(0.018)	(0.016)
SMB	0.207***	0.089	0.159***	0.149***	0.080	0.067	0.048	−0.030	−0.006	−0.320***
	(0.062)	(0.057)	(0.054)	(0.050)	(0.055)	(0.043)	(0.055)	(0.048)	(0.045)	(0.031)
HML	−0.016	−0.021	−0.019	0.085*	0.166***	0.218***	0.074	0.002	0.064*	0.018
	(0.053)	(0.035)	(0.058)	(0.050)	(0.043)	(0.044)	(0.065)	(0.076)	(0.033)	(0.046)
WML	−0.050*	−0.015	−0.109***	−0.035	−0.073***	−0.029*	0.023	−0.033	−0.035*	0.111***
	(0.027)	(0.026)	(0.037)	(0.025)	(0.023)	(0.015)	(0.019)	(0.024)	(0.021)	(0.025)
UMS	0.477***	0.548***	0.525***	0.257***	0.288***	0.308***	−0.053	−0.024	−0.281***	−0.210***
	(0.085)	(0.064)	(0.103)	(0.090)	(0.080)	(0.064)	(0.057)	(0.058)	(0.060)	(0.074)
Constant	−0.001	0.001*	0.0003	0.001	0.0005	−0.00004	−0.0001	−0.0004	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	288	288	289	288	288	288	289	288	289
Adjusted R^2	0.932***	0.967***	0.963***	0.971***	0.969***	0.978***	0.979	0.964	0.981***	0.979***
ES										
Market	0.954***	1.043***	1.033***	1.018***	1.087***	1.070***	0.976***	1.009***	1.023***	0.967***
	(0.039)	(0.036)	(0.020)	(0.027)	(0.021)	(0.020)	(0.027)	(0.027)	(0.013)	(0.019)

Table 4 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SMB	0.152***	0.163***	0.139***	0.097*	0.074	0.133**	0.034	0.081	−0.057	−0.288***
	(0.059)	(0.055)	(0.045)	(0.053)	(0.068)	(0.055)	(0.042)	(0.065)	(0.047)	(0.030)
HML	−0.079	−0.122**	0.088**	0.075	0.048	0.137**	0.064	0.148***	0.094*	0.003
	(0.049)	(0.049)	(0.039)	(0.064)	(0.059)	(0.061)	(0.069)	(0.049)	(0.051)	(0.046)
WML	−0.003	−0.102***	−0.061**	−0.055	0.032	−0.003	−0.034	−0.025	0.037	0.061***
	(0.030)	(0.025)	(0.026)	(0.034)	(0.024)	(0.020)	(0.025)	(0.027)	(0.026)	(0.014)
UMS	0.286***	0.603***	0.469***	0.349***	0.197***	0.151*	0.012	0.081	−0.139**	−0.314***
	(0.097)	(0.077)	(0.086)	(0.072)	(0.065)	(0.078)	(0.064)	(0.060)	(0.063)	(0.048)
Constant	−0.0003	0.002*	0.0002	0.00002	0.0002	−0.0003	−0.001	−0.001	−0.001**	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	289	288	288	289	289	288	288	289	288	288
Adjusted R^2	0.939***	0.964***	0.975***	0.961***	0.964**	0.974**	0.970	0.972	0.981***	0.983***
ESG										
Market	0.968***	1.045***	1.059***	1.042***	1.096***	1.015***	1.040***	0.978***	1.021***	0.959***
	(0.034)	(0.015)	(0.016)	(0.018)	(0.033)	(0.028)	(0.013)	(0.015)	(0.020)	(0.021)
SMB	0.165**	0.199***	0.136***	0.102**	0.100*	0.201***	0.108**	0.002	−0.025	−0.295***
	(0.069)	(0.055)	(0.046)	(0.045)	(0.057)	(0.068)	(0.052)	(0.053)	(0.047)	(0.027)
HML	−0.104*	−0.006	−0.006	0.006	0.106*	0.184***	0.029	0.088	0.081*	0.020
	(0.060)	(0.042)	(0.039)	(0.029)	(0.064)	(0.071)	(0.043)	(0.067)	(0.045)	(0.035)
WML	0.018	−0.055***	−0.116***	−0.059	−0.011	−0.020	−0.002	−0.024	0.017	0.072***
	(0.035)	(0.020)	(0.043)	(0.038)	(0.037)	(0.028)	(0.030)	(0.030)	(0.027)	(0.015)
UMS	0.409***	0.498***	0.468***	0.204**	0.186**	0.010	0.063	0.094	−0.153***	−0.297***
	(0.117)	(0.057)	(0.080)	(0.087)	(0.094)	(0.077)	(0.080)	(0.085)	(0.055)	(0.047)
Constant	−0.0003	0.002***	−0.00005	0.001	−0.001	−0.0002	−0.001**	−0.0001	−0.0003	−0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)	(0.001)
Observations	296	288	285	286	289	287	288	288	288	289
Adjusted R^2	0.920***	0.973***	0.970***	0.959**	0.965**	0.968	0.973	0.974	0.985***	0.986***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, adjusted R^2 indications are from *F*-tests for nested models. Newey–West standard errors are reported in parentheses.

obtained results are more or less unambiguous for the factors built with rating data of all three providers.

UMS factors built upon five different ESG categories (E, S, G, ES and ESG) enhance the explanatory power in four- and five-factor models throughout almost all of our constructed decile portfolios containing those stocks with the least to highest scores in terms of one particular ESG dimension. Furthermore, we obtain significant increases of R^2 through our added UMS factors as indicated by our *F*-tests for nested models and the corresponding significance levels. Our R^2 are above .9 for most cases and even above .95 for some cases which is quite high, however also quite expected for Fama–French and Carhart models applied to well-diversified portfolios. Overall, our decile portfolios load almost always significantly on our constructed UMS factors. This applies to the variable constructions with ASSET4, Refinitiv and Vigeo Eiris, likewise. While the lowest deciles in our time-series regressions produce positive loadings on our UMS factors, the loadings become negative the higher one ascends in deciles. Typically, the sign reversal occurs between the 6th decile and the 8th decile, slightly depending on ESG dimension and rating provider. The general pattern in loadings across all dimensions of each rating provider indicates that value-weighted well-diversified portfolios containing the overall market do somehow move with an additional risk factor that captures an underlying risk component related to ESG. Thus, if the return of our constructed UMS factor changes by one standardized unit, the return of the decile portfolios containing the stocks with the lowest (highest) scores does by tendency increase (decrease). Again, the marginal change in the decile portfolios' returns depends on ESG dimension and rating provider.

Table 5 Vigeo Eiris world: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.055***	1.114***	1.040***	1.099***	1.081***	1.029***	1.069***	1.145***	1.062***	1.085***
	(0.037)	(0.048)	(0.019)	(0.038)	(0.031)	(0.031)	(0.039)	(0.066)	(0.022)	(0.036)
SMB	0.044	0.012	0.152*	−0.027	0.001	−0.020	−0.144	−0.176*	−0.250***	−0.340***
	(0.117)	(0.145)	(0.085)	(0.064)	(0.077)	(0.082)	(0.104)	(0.097)	(0.096)	(0.089)
HML	−0.137**	−0.013	0.061	−0.010	0.212***	0.164*	0.087	−0.020	0.139***	0.128
	(0.055)	(0.109)	(0.064)	(0.096)	(0.069)	(0.087)	(0.103)	(0.091)	(0.039)	(0.089)
WML	−0.023	−0.098	−0.016	0.029	0.021	0.031	0.062	0.017	0.074**	−0.085*
	(0.047)	(0.086)	(0.029)	(0.044)	(0.033)	(0.056)	(0.055)	(0.056)	(0.035)	(0.051)
UMS	0.196**	0.172*	0.238***	0.008	0.116	−0.013	0.017	0.043	−0.155***	−0.223**
	(0.099)	(0.095)	(0.038)	(0.082)	(0.079)	(0.058)	(0.074)	(0.151)	(0.032)	(0.102)
Constant	−0.0003	0.001	−0.0004	0.0002	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	179	153	160	164	163	155	158	160	159	150
Adjusted R^2	0.907***	0.925***	0.943***	0.934	0.948**	0.938	0.930	0.928	0.950***	0.936***
Governance										
Market	1.023***	1.046***	1.109***	1.091***	1.123***	1.114***	1.071***	1.087***	1.072***	1.078***
	(0.085)	(0.031)	(0.014)	(0.024)	(0.022)	(0.018)	(0.026)	(0.034)	(0.033)	(0.023)
SMB	0.228**	0.149**	0.021	−0.148**	−0.023	−0.095	−0.243***	−0.320***	−0.167**	−0.149
	(0.108)	(0.072)	(0.093)	(0.070)	(0.106)	(0.086)	(0.064)	(0.077)	(0.080)	(0.094)
HML	0.026	0.017	0.065	0.052	0.149**	0.138*	−0.009	0.007	0.190***	0.149***
	(0.099)	(0.058)	(0.069)	(0.052)	(0.066)	(0.075)	(0.082)	(0.086)	(0.058)	(0.048)
WML	−0.120	−0.109***	0.027	0.055**	0.111**	0.017	0.027	−0.074	−0.006	0.002
	(0.084)	(0.028)	(0.021)	(0.027)	(0.056)	(0.029)	(0.020)	(0.070)	(0.028)	(0.033)
UMS	0.623***	0.457***	0.310***	0.174***	0.140	0.134	0.073	−0.189***	−0.139**	−0.197***
	(0.108)	(0.073)	(0.054)	(0.047)	(0.094)	(0.092)	(0.073)	(0.062)	(0.064)	(0.044)
Constant	−0.002	−0.0004	−0.002*	0.0003	0.001	0.0003	−0.0003	0.0002	−0.002*	−0.002**
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	170	162	154	162	158	163	161	157	156	157
Adjusted R^2	0.877***	0.935***	0.947***	0.957***	0.939***	0.943***	0.942	0.917***	0.951***	0.949***
Social										
Market	1.095***	1.103***	1.082***	1.090***	1.024***	1.056***	1.019***	1.142***	1.049***	1.128***
	(0.083)	(0.025)	(0.034)	(0.042)	(0.023)	(0.024)	(0.020)	(0.058)	(0.020)	(0.031)
SMB	0.244**	0.037	−0.024	0.024	0.044	−0.038	−0.168**	−0.223**	−0.222***	−0.309***
	(0.121)	(0.094)	(0.112)	(0.089)	(0.065)	(0.096)	(0.078)	(0.090)	(0.070)	(0.095)
HML	0.003	−0.115	−0.030	0.122	0.045	0.174***	0.114*	0.116	0.015	0.122
	(0.095)	(0.088)	(0.069)	(0.077)	(0.095)	(0.046)	(0.061)	(0.100)	(0.069)	(0.096)
WML	−0.055	−0.012	0.044	−0.058	−0.004	0.053	0.072***	0.015	0.022	0.019
	(0.068)	(0.029)	(0.028)	(0.036)	(0.038)	(0.034)	(0.024)	(0.076)	(0.027)	(0.038)
UMS	0.326**	0.251***	0.252***	0.134*	0.009	0.073	0.016	−0.041	−0.191***	−0.390***
	(0.127)	(0.088)	(0.075)	(0.076)	(0.075)	(0.076)	(0.062)	(0.104)	(0.063)	(0.098)
Constant	−0.001	0.001	0.001	0.00002	−0.00003	0.001	−0.001	−0.001	−0.003***	−0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	165	163	162	161	159	160	158	158	158	157
Adjusted R^2	0.901***	0.942***	0.931***	0.938**	0.941	0.946	0.951	0.929	0.957***	0.942***
ES										
Market	1.044***	1.114***	1.028***	1.160***	1.053***	0.998***	1.076***	1.119***	1.064***	1.118***
	(0.044)	(0.050)	(0.028)	(0.053)	(0.037)	(0.028)	(0.037)	(0.053)	(0.030)	(0.027)

Table 5 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SMB	0.106	−0.024	0.170**	−0.089	−0.024	0.066	−0.137	−0.253***	−0.178**	−0.360***
	(0.120)	(0.121)	(0.071)	(0.110)	(0.103)	(0.094)	(0.095)	(0.085)	(0.077)	(0.099)
HML	−0.123*	0.096	−0.051	0.034	0.144	0.165**	0.046	0.021	0.192***	0.061
	(0.070)	(0.108)	(0.048)	(0.137)	(0.098)	(0.078)	(0.060)	(0.081)	(0.056)	(0.080)
WML	0.032	−0.030	−0.071**	0.017	−0.064	0.110***	0.044	0.019	0.067	−0.049
	(0.033)	(0.069)	(0.035)	(0.081)	(0.040)	(0.041)	(0.030)	(0.060)	(0.048)	(0.034)
UMS	0.261***	0.299***	0.137**	0.282**	0.015	−0.002	−0.0004	0.093	−0.131***	−0.317***
	(0.092)	(0.086)	(0.068)	(0.118)	(0.069)	(0.064)	(0.070)	(0.126)	(0.041)	(0.097)
Constant	0.001	−0.0002	0.0004	0.0003	−0.0003	0.001	0.0003	−0.001	−0.001	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	169	163	164	168	162	160	163	149	152	150
Adjusted R^2	0.908***	0.930***	0.956***	0.924***	0.940	0.923	0.946	0.945*	0.952***	0.942***
ESG										
Market	0.997***	1.120***	1.111***	1.086***	1.042***	1.036***	1.157***	1.016***	1.059***	1.146***
	(0.057)	(0.028)	(0.062)	(0.037)	(0.028)	(0.038)	(0.060)	(0.022)	(0.029)	(0.037)
SMB	0.186	−0.117	0.271***	−0.008	−0.040	0.025	−0.082	−0.224***	−0.270***	−0.358***
	(0.148)	(0.093)	(0.094)	(0.076)	(0.071)	(0.093)	(0.097)	(0.081)	(0.062)	(0.098)
HML	−0.127	0.061	0.066	0.193**	−0.027	0.135	−0.108	0.168***	0.142***	0.090
	(0.091)	(0.070)	(0.060)	(0.078)	(0.098)	(0.111)	(0.074)	(0.049)	(0.035)	(0.074)
WML	−0.019	−0.057	−0.089***	0.045	−0.026	0.024	0.018	0.127***	0.099***	−0.088
	(0.051)	(0.046)	(0.032)	(0.043)	(0.027)	(0.042)	(0.045)	(0.037)	(0.030)	(0.059)
UMS	0.316*	0.368***	0.279***	0.208***	0.090	0.030	0.0004	−0.113**	−0.182***	−0.203**
	(0.179)	(0.078)	(0.105)	(0.072)	(0.072)	(0.086)	(0.123)	(0.045)	(0.021)	(0.085)
Constant	−0.001	−0.0003	0.002*	0.0002	0.001	0.001	−0.0001	−0.001	−0.002*	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	184	163	154	173	145	158	161	151	160	151
Adjusted R^2	0.881***	0.939***	0.944***	0.938***	0.936	0.921	0.939	0.944**	0.953***	0.943***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, adjusted R^2 indications are from *F* tests for nested models. Newey–West standard errors are reported in parentheses.

For our regressions with ASSET4 data, our highest marginal change in the dependent variables in response to a change in our UMS factor is +.56 for the Environmental dimension, whereas our smallest is −.23 for the ESG dimension. For Refinitiv, the magnitudes are even higher with a highest marginal change of .66 and an almost equally high marginal change of .65 for the Environmental and Governance dimensions, respectively. The lowest response of our decile portfolios to a one unit change in our UMS factor is obtained for the Governance dimension with a response of −.23 for one of the highest deciles. The loadings produced by Vigeo Eiris regressions are somewhat different, yet the overall identified pattern from positive to negative loadings does remain across deciles. While portfolios containing those stocks with the lowest Governance scores respond with a return increase of .65% to an increase of 1% in our UMS factor's return, the produced loadings on our other ESG dimensions are quite low. Yet, as mentioned before and most importantly we obtain negative loadings on UMS factors for higher decile portfolios and positive loadings for lower deciles concomitant with significant increases in R^2, indicating that our constructed factors do in fact enhance the overall model quality.

The obtained loadings on our other factors, namely market, SMB, HML and WML, do for the most part not show any particular patterns. However, for SMB it applies that lower deciles rather load positively on SMB, whereas higher deciles produce negative loadings, suggesting that our lower (higher) decile portfolios rather consist of small (large) cap stocks. Furthermore, loadings on SMB, HML, and WML are significant in more cases for ASSET4 and Refinitiv regressions, as opposed to regressions conducted with Vigeo Eiris ESG data. This is evidence for that decile portfolios built upon Vigeo Eiris ESG data are less exposed

to either of the three factors. In sum, it can be said that UMS is an important factor in common asset-pricing models for the global market, as indicated by our *F*-tests for nested models as well as by our significant loadings on our UMS factor portfolios.

Robustness checks

To check our results for robustness across geographies, we conduct the same regression models for the North American and the European markets, respectively. For Europe, our time-series starts in July 2007 and for North America in July 2012. We chose the earliest possible date which still warrants well-diversified portfolios. Both time-series end in June 2020 just like for the global market. Thus, our time-series finally comprise 156, and 96 observations of monthly returns, respectively. For our regressions, we take the Fama–French European and North American factors for the corresponding time-series. We present the results in the Appendix. Overall, we conclude that there are UMS factors that explain common variation in returns in the European and the North American markets just like in the global market. Thus, such factors should be included in common asset-pricing models not only for the global market but also for regional markets like North America and Europe.

Conclusion

Our results indicate that there are risk factors related to ESG that are relevant explanatory variables in multifactor asset-pricing models regardless of the methodology used to measure a company's ESG performance. This finding holds across all dimensions of ESG (i.e., E, S, G, ES and ESG) and across all considered geographies. For each ESG dimension, it applies that factor loadings of well-diversified portfolios with ascending ESG scores exhibit negative (positive) loadings on UMS factors, where the loadings are positive (negative) for lowest (highest) deciles. These positive loadings which revert somewhere around the mid deciles succeeded by negative loadings on UMS for the upper deciles are in line with how loadings on well-specified risk factors in common asset-pricing models should behave. Therefore, it can be useful to investors to consider a risk factor related to ESG in standard asset-pricing models to account for the possible resulting effects on expected returns. ESG factor premiums are on average indistinguishable from zero for the given timespan indicating that investors did on average not earn a premium for holding unsustainable assets which is in line with the conclusions made by Friede et al. (2015) and Wallis and Klein (2015). This finding is contrasting with the error-in-expectations hypothesis, the shunned-stock hypothesis and the environmental-risk hypothesis.

We argue that even though ESG risk is on average not priced for the timespan of our sample time-series, the exhibited factor loadings and the increased model quality suffice to warrant the relevance of our factor. ESG-related factors can be used, e.g., in portfolio management to adjust a portfolio's exposure to ESG-related risks, even though the factor premium is zero for the investigated timespan. Since more complex asset-pricing models by commercial providers are usually used in practice, it would be interesting in future research to examine to what extent ESG-related risk factors remain relevant for such models. What is more, and as argued by Pástor et al. (2021) it is of major importance to differentiate between expected and realized returns. Insignificant alphas related to ESG strategies for a given timespan might be the result of investors' shifting demand toward ESG stocks offsetting actual negative alphas as a result of, e.g., a lack of diversification or higher costs of capital for sin companies. Therefore, the main focus of further research should be on disentangling alphas related to unexpected changes in investors' demand that might push negative intercepts toward zero.

Appendix

See Tables 6, 7, 8, 9, 10, 11, 12 and 13.

Table 6 Summary statistics: North America and Europe

	North America		Europe	
	Mean	SD	Mean	SD
Market	0.004	0.038	−0.005	0.064
SMB	−0.002	0.023	0.0003	0.019
HML	−0.006**	0.027	−0.004*	0.025
WML	0.004	0.029	0.007**	0.041
ASSET4				
UMS_{ENV}	0.002	0.016	0.001	0.018
UMS_{GOV}	0.001	0.015	0.001	0.019
UMS_{SOC}	0.002	0.017	0.0002	0.018
UMS_{ES}	0.002	0.016	0.002	0.018
UMS_{ESG}	0.002	0.017	0.001	0.017
Refinitiv				
UMS_{ENV}	0.002	0.016	0.0005	0.017
UMS_{GOV}	0.004**	0.018	0.001	0.016
UMS_{SOC}	0.002	0.017	−0.001	0.016
UMS_{ES}	0.002	0.017	0.001	0.017
UMS_{ESG}	0.003	0.018	0.001	0.016
Vigeo Eiris				
UMS_{ENV}	−0.004	0.030	0.000	0.025
UMS_{GOV}	−0.002	0.026	0.001	0.021
UMS_{SOC}	0.002	0.043	0.002	0.025
UMS_{ES}	−0.001	0.033	0.001	0.025
UMS_{ESG}	−0.0002	0.034	0.0001	0.024

This table shows means, standard deviations and significance levels for the independent variables in the time-series regressions for the North American and the European markets, respectively

*, ** and *** denote significance levels for independent t-tests on the 10%, 5% and 1% levels, respectively

Table 7 Correlations

Panel A. North America				
	Market	SMB	HML	WML
Market	1.000***	0.451***	0.119	−0.334***
SMB	0.451***	1.000***	0.131	−0.214**
HML	0.119	0.131	1.000***	−0.623***
WML	−0.334***	−0.214**	−0.623***	1.000***
ASSET4				
UMS_{ENV}	−0.272***	0.009	−0.534***	0.469***
UMS_{GOV}	0.031	0.102	−0.271***	0.239**
UMS_{SOC}	−0.167	−0.046	−0.613***	0.513***
UMS_{ES}	−0.148	0.060	−0.545***	0.471***
UMS_{ESG}	−0.221**	−0.007	−0.560***	0.509***
Refinitiv				
UMS_{ENV}	−0.269***	0.001	−0.543***	0.503***
UMS_{GOV}	−0.045	0.003	−0.549***	0.349***
UMS_{SOC}	−0.315***	−0.073	−0.461***	0.577***
UMS_{ES}	−0.187	0.099	−0.584***	0.554***
UMS_{ESG}	−0.129**	0.094	−0.589***	0.506***
Vigeo Eiris				
UMS_{ENV}	0.040	0.073	−0.136	0.130
UMS_{GOV}	−0.233**	−0.091	−0.386***	0.348***
UMS_{SOC}	−0.035	−0.005	−0.305***	0.255**
UMS_{ES}	0.007	0.038	−0.230**	0.213**
UMS_{ESG}	−0.015	0.025	−0.231**	0.214**
Panel C. Europe				
	Market	SMB	HML	WML
Market	1.000***	0.055	0.459***	−0.484***
SMB	0.055	1.000***	−0.042	−0.038
HML	0.459***	−0.042	1.000***	−0.519***
WML	−0.484***	−0.038	−0.519***	1.000***
ASSET4				
UMS_{ENV}	−0.094	0.383***	−0.394***	0.198**
UMS_{GOV}	0.223***	0.002	0.017	0.056
UMS_{SOC}	0.093	0.521***	−0.251***	−0.022
UMS_{ES}	−0.068	0.471***	−0.419***	0.138*
UMS_{ESG}	0.074	0.361***	−0.268***	0.033
Refinitiv				
UMS_{ENV}	−0.031	0.385***	−0.382***	0.157*
UMS_{GOV}	0.125	−0.092	0.024	0.079
UMS_{SOC}	0.166**	0.418***	−0.031	−0.095
UMS_{ES}	0.021	0.402***	−0.357***	0.147*
UMS_{ESG}	0.051	0.412***	−0.344***	0.101
Vigeo Eiris				
UMS_{ENV}	0.418***	0.390***	−0.073	−0.206
UMS_{GOV}	0.253***	−0.077	−0.084	0.095**
UMS_{SOC}	0.159**	0.381***	−0.306***	−0.083
UMS_{ES}	0.324***	0.371***	−0.197**	−0.117
UMS_{ESG}	0.409***	0.314***	−0.134*	−0.235***

This table shows Pearson correlations of the independent variables in the time-series regressions for the North American and the European markets, respectively

*, ** and *** denote significance levels on the 10%, 5% and 1% levels, respectively

Table 8 ASSET4 North America: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.090***	1.132***	1.145***	1.213***	1.113***	1.103***	0.973***	0.956***	1.060***	0.968***
	(0.054)	(0.042)	(0.049)	(0.068)	(0.042)	(0.041)	(0.028)	(0.030)	(0.029)	(0.030)
SMB	0.134***	0.206***	0.149**	0.180**	0.086	0.103	0.036	0.028	−0.006	−0.184***
	(0.047)	(0.075)	(0.059)	(0.089)	(0.079)	(0.064)	(0.057)	(0.053)	(0.040)	(0.035)
HML	−0.009	−0.123**	0.050	0.004	0.075	0.159***	−0.083	0.107*	0.056	−0.024
	(0.064)	(0.060)	(0.072)	(0.096)	(0.069)	(0.059)	(0.076)	(0.058)	(0.045)	(0.048)
WML	−0.073	−0.117	−0.016	0.179**	0.095**	−0.009	−0.035	0.071	−0.008	−0.021
	(0.082)	(0.077)	(0.062)	(0.081)	(0.040)	(0.058)	(0.067)	(0.055)	(0.037)	(0.045)
UMS	0.599***	0.811***	0.737***	0.010	0.154**	0.360***	−0.037	−0.109	−0.153	−0.287***
	(0.117)	(0.091)	(0.100)	(0.094)	(0.076)	(0.111)	(0.098)	(0.097)	(0.095)	(0.046)
Constant	−0.0004	0.00005	−0.002	0.002	0.0004	0.001	−0.0001	0.001	0.0004	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	105	94	98	99	98	98	98	98	99	99
Adjusted R^2	0.905***	0.919***	0.924***	0.912	0.917	0.917***	0.899	0.936	0.961**	0.953***
Governance										
Market	1.158***	1.117***	1.117***	0.968***	1.106***	0.955***	0.944***	1.073***	1.031***	1.009***
	(0.053)	(0.044)	(0.032)	(0.030)	(0.069)	(0.033)	(0.039)	(0.020)	(0.044)	(0.026)
SMB	0.110	0.201***	0.152**	0.104**	0.118*	−0.018	0.022	−0.087**	0.019	−0.225***
	(0.083)	(0.076)	(0.063)	(0.048)	(0.068)	(0.049)	(0.065)	(0.043)	(0.046)	(0.052)
HML	−0.291***	0.078	0.055	0.019	0.084	0.110	0.073	0.176***	−0.077	−0.080
	(0.088)	(0.048)	(0.039)	(0.048)	(0.097)	(0.079)	(0.063)	(0.046)	(0.052)	(0.052)
WML	−0.197**	0.002	0.084	0.009	0.046	−0.040	−0.067	0.055	0.063	−0.056
	(0.091)	(0.074)	(0.052)	(0.046)	(0.071)	(0.074)	(0.061)	(0.039)	(0.052)	(0.047)
UMS	0.499***	0.697***	0.291***	0.104	−0.027	−0.018	0.031	−0.086	−0.387***	−0.181***
	(0.134)	(0.153)	(0.089)	(0.074)	(0.085)	(0.137)	(0.108)	(0.058)	(0.041)	(0.049)
Constant	0.0002	−0.001	0.00001	0.0005	−0.001	0.002	−0.001	−0.0001	0.0003	−0.00003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	99	98	99	98	99	98	99	98	99	99
Adjusted R^2	0.884***	0.893***	0.944***	0.932	0.889	0.905	0.917	0.945	0.921***	0.938**
Social										
Market	1.008***	1.197***	1.121***	1.119***	1.180***	1.024***	1.078***	1.084***	0.959***	0.952***
	(0.046)	(0.051)	(0.061)	(0.039)	(0.059)	(0.029)	(0.024)	(0.061)	(0.037)	(0.023)
SMB	0.181**	0.124	0.111*	0.199***	0.045	0.227***	0.067	0.113*	−0.133***	−0.230***
	(0.081)	(0.093)	(0.063)	(0.072)	(0.080)	(0.074)	(0.045)	(0.068)	(0.033)	(0.044)
HML	0.018	−0.001	−0.044	−0.038	−0.104	0.006	0.087	0.276***	0.013	0.002
	(0.084)	(0.114)	(0.069)	(0.061)	(0.141)	(0.129)	(0.059)	(0.099)	(0.058)	(0.042)
WML	−0.061	0.005	−0.089	−0.096	0.059	0.097	0.013	0.153**	0.070	−0.097**
	(0.090)	(0.106)	(0.060)	(0.060)	(0.082)	(0.067)	(0.042)	(0.077)	(0.058)	(0.043)
UMS	0.662***	0.700***	0.589***	0.343***	−0.021	−0.164*	0.137*	−0.212***	−0.270***	−0.145***
	(0.092)	(0.172)	(0.111)	(0.099)	(0.121)	(0.093)	(0.082)	(0.064)	(0.068)	(0.051)
Constant	0.001	−0.001	0.0005	0.001	−0.002	0.002	0.002*	−0.001	0.001	−0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	99	99	99	99	99	98	98	99	99	99
Adjusted R^2	0.873***	0.868***	0.917***	0.931***	0.841	0.864	0.933	0.932**	0.939***	0.950**
ES										
Market	0.998***	1.152***	1.179***	1.064***	1.201***	0.984***	1.085***	1.052***	1.002***	0.958***
	(0.033)	(0.058)	(0.072)	(0.039)	(0.043)	(0.032)	(0.039)	(0.038)	(0.039)	(0.017)

Table 8 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SMB	0.196***	0.165***	0.137	0.151**	0.155*	0.180***	−0.074	0.113**	−0.033	−0.221***
	(0.069)	(0.054)	(0.084)	(0.063)	(0.087)	(0.046)	(0.048)	(0.050)	(0.049)	(0.035)
HML	−0.045	−0.102	0.101	−0.035	0.072	0.128***	−0.263***	0.083	0.198***	−0.006
	(0.095)	(0.082)	(0.112)	(0.093)	(0.058)	(0.039)	(0.079)	(0.064)	(0.046)	(0.048)
WML	−0.028	−0.225***	0.059	0.035	0.118*	0.107***	−0.152**	0.089*	0.129***	−0.075
	(0.083)	(0.085)	(0.066)	(0.057)	(0.061)	(0.035)	(0.060)	(0.049)	(0.041)	(0.046)
UMS	0.747***	0.753***	0.495***	0.159**	0.207*	0.069	−0.091	−0.044	−0.240***	−0.195***
	(0.109)	(0.134)	(0.095)	(0.080)	(0.113)	(0.071)	(0.100)	(0.091)	(0.077)	(0.039)
Constant	−0.001	−0.001	0.001	0.00000	0.001	0.001	−0.001	0.001	0.0005	−0.0002
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	99	99	98	99	99	98	98	99	99	99
Adjusted R^2	0.881***	0.908***	0.922	0.916	0.911*	0.946	0.892	0.923	0.935***	0.957***
ESG										
Market	1.181***	1.051***	1.131***	1.138***	1.072***	1.061***	1.075***	1.049***	0.989***	0.948***
	(0.062)	(0.032)	(0.068)	(0.040)	(0.051)	(0.035)	(0.050)	(0.031)	(0.034)	(0.026)
SMB	0.095	0.233**	0.239**	0.131*	0.089	0.110**	0.005	0.100**	0.009	−0.266***
	(0.075)	(0.092)	(0.093)	(0.077)	(0.067)	(0.053)	(0.052)	(0.042)	(0.040)	(0.047)
HML	−0.165**	−0.162**	0.144*	−0.100	0.143**	0.053	−0.145**	0.129**	0.190***	−0.086**
	(0.077)	(0.076)	(0.087)	(0.087)	(0.057)	(0.052)	(0.071)	(0.053)	(0.036)	(0.040)
WML	−0.232**	−0.047	0.085	−0.065	0.187***	−0.025	−0.063	0.133***	0.102**	−0.086**
	(0.099)	(0.048)	(0.063)	(0.069)	(0.046)	(0.041)	(0.060)	(0.034)	(0.047)	(0.042)
UMS	0.833***	0.576***	0.378***	0.329**	0.107	0.142***	−0.108	−0.131	−0.157***	−0.226***
	(0.116)	(0.089)	(0.102)	(0.135)	(0.077)	(0.055)	(0.101)	(0.089)	(0.061)	(0.049)
Constant	−0.001	0.002	0.00001	−0.0003	0.002	0.0004	−0.001	−0.00003	0.0005	0.0001
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	99	99	99	99	98	98	99	99	98	99
Adjusted R^2	0.880***	0.893***	0.918***	0.913***	0.896	0.930	0.910	0.928	0.951**	0.956***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively

Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, and adjusted R^2 indications are from *F*-tests for nested models. Newey–West standard errors are reported in parentheses

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG. *, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, and adjusted R^2 indications are from F-tests for nested models. Newey–West standard errors are reported in parentheses.

Table 9 Refinitiv North America: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.110***	0.672***	1.108***	1.049***	1.129***	1.208***	1.100***	0.985***	0.942***	1.009***
	(0.028)	(0.214)	(0.034)	(0.031)	(0.067)	(0.051)	(0.034)	(0.037)	(0.027)	(0.022)
SMB	0.195***	0.419***	0.235***	0.281***	0.206**	0.073	0.080	0.118**	−0.088*	−0.196***
	(0.042)	(0.135)	(0.051)	(0.051)	(0.094)	(0.067)	(0.055)	(0.056)	(0.049)	(0.032)
HML	−0.112**	0.131	0.138*	0.034	0.052	0.270***	0.009	0.126***	0.114***	−0.089**
	(0.053)	(0.128)	(0.078)	(0.054)	(0.109)	(0.057)	(0.073)	(0.046)	(0.030)	(0.038)
WML	−0.081	0.003	−0.087	0.119***	0.105*	0.076	−0.033	−0.037	0.050	−0.017
	(0.057)	(0.182)	(0.072)	(0.046)	(0.059)	(0.055)	(0.048)	(0.056)	(0.045)	(0.032)
UMS	0.691***	−0.248	0.478***	0.127	0.0003	0.164**	0.237**	−0.071	−0.020	−0.301***
	(0.092)	(0.393)	(0.137)	(0.132)	(0.086)	(0.068)	(0.097)	(0.051)	(0.089)	(0.053)
Constant	0.001	−0.004	−0.002	0.001	0.002	0.001	−0.00001	−0.001	−0.0004	0.0001
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	187	21	93	95	99	98	99	98	99	99
Adjusted R^2	0.951***	0.574	0.921***	0.931	0.916	0.924	0.916**	0.944	0.929	0.961***
Governance										
Market	1.055***	1.018***	1.091***	1.048***	1.021***	1.151***	0.985***	1.043***	1.076***	0.925***
	(0.048)	(0.052)	(0.038)	(0.037)	(0.043)	(0.043)	(0.025)	(0.033)	(0.026)	(0.037)
SMB	0.185***	0.050	0.161***	−0.005	0.065	0.024	−0.003	−0.098*	−0.047	−0.048
	(0.067)	(0.067)	(0.048)	(0.069)	(0.066)	(0.062)	(0.049)	(0.054)	(0.047)	(0.058)
HML	−0.055	−0.098	0.036	0.097*	0.041	0.147	0.101**	−0.088	0.024	−0.045
	(0.073)	(0.067)	(0.043)	(0.053)	(0.053)	(0.097)	(0.041)	(0.057)	(0.050)	(0.062)
WML	−0.139	−0.003	0.025	0.039	0.002	−0.024	0.047	0.066	0.001	−0.046
	(0.094)	(0.091)	(0.051)	(0.058)	(0.063)	(0.074)	(0.050)	(0.048)	(0.043)	(0.052)
UMS	0.620***	0.399***	0.289***	0.111	−0.104	−0.022	−0.037	−0.173***	−0.127***	−0.302***
	(0.133)	(0.112)	(0.072)	(0.072)	(0.075)	(0.093)	(0.059)	(0.061)	(0.043)	(0.062)
Constant	0.0001	−0.001	−0.0001	0.001	0.002**	−0.002*	0.001	−0.001	0.0003	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	104	101	101	102	102	101	102	101	102	102
Adjusted R^2	0.896***	0.900***	0.955***	0.935	0.917	0.928	0.926	0.921**	0.949**	0.924***
Social										
Market	1.046***	1.045***	1.168***	1.157***	1.074***	1.170***	1.043***	1.056***	0.997***	0.968***
	(0.031)	(0.036)	(0.039)	(0.054)	(0.032)	(0.036)	(0.039)	(0.041)	(0.046)	(0.017)
SMB	0.101	0.155***	0.247***	0.249***	0.276***	0.198***	0.016	−0.007	−0.042	−0.222***
	(0.083)	(0.051)	(0.056)	(0.070)	(0.068)	(0.067)	(0.049)	(0.061)	(0.066)	(0.037)
HML	−0.067	−0.093	0.132**	0.084	0.227***	0.279***	0.127*	0.008	−0.086	−0.012
	(0.062)	(0.064)	(0.059)	(0.084)	(0.061)	(0.085)	(0.073)	(0.054)	(0.063)	(0.037)
WML	−0.025	−0.028	−0.004	0.053	0.004	0.007	−0.073	0.024	0.045	0.010
	(0.082)	(0.063)	(0.052)	(0.088)	(0.093)	(0.076)	(0.045)	(0.045)	(0.050)	(0.050)
UMS	0.447***	0.439***	0.390***	0.254***	0.192	0.357***	0.109	−0.085	−0.289***	−0.201***
	(0.134)	(0.074)	(0.102)	(0.078)	(0.117)	(0.085)	(0.073)	(0.070)	(0.057)	(0.068)
Constant	−0.0004	0.001	0.0003	0.002***	0.0002	0.0001	0.002	0.00001	0.0002	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	102	102	101	102	102	101	102	101	102	102
Adjusted R^2	0.887***	0.916***	0.938***	0.937***	0.913*	0.930***	0.946	0.921	0.927***	0.952***
ES										
Market	1.087***	1.308***	1.125***	1.000***	1.071***	1.142***	1.124***	1.140***	1.047***	0.971***
	(0.034)	(0.064)	(0.040)	(0.034)	(0.040)	(0.063)	(0.045)	(0.027)	(0.028)	(0.017)

Table 9 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SMB	0.167*	0.274***	0.193***	0.202***	0.262***	0.149*	0.155***	0.092*	−0.041	−0.216***
	(0.091)	(0.068)	(0.065)	(0.049)	(0.061)	(0.090)	(0.057)	(0.049)	(0.043)	(0.032)
HML	−0.203**	0.025	0.145*	−0.060	0.183***	0.153	0.231***	0.072*	0.100*	−0.111***
	(0.084)	(0.076)	(0.079)	(0.047)	(0.059)	(0.107)	(0.055)	(0.037)	(0.053)	(0.043)
WML	−0.089	−0.137	0.036	−0.114**	0.112**	−0.041	0.139***	−0.034	−0.023	0.018
	(0.069)	(0.104)	(0.069)	(0.047)	(0.053)	(0.061)	(0.052)	(0.040)	(0.048)	(0.036)
UMS	0.514***	0.794***	0.536***	0.147**	0.194*	0.027	0.110**	0.123*	−0.011	−0.292***
	(0.142)	(0.171)	(0.111)	(0.074)	(0.112)	(0.073)	(0.054)	(0.072)	(0.076)	(0.050)
Constant	0.001	−0.003*	0.001	−0.001	0.001	0.0002	0.002*	−0.001	−0.0001	−0.0001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	100	102	98	98	97	99	98	99	98	99
Adjusted s^2	0.890***	0.895***	0.907***	0.939*	0.938**	0.925	0.933	0.955	0.950	0.964***
ESG										
Market	1.265***	1.168***	0.934***	1.044***	1.078***	1.106***	1.191***	1.162***	1.017***	0.974***
	(0.049)	(0.041)	(0.035)	(0.046)	(0.069)	(0.040)	(0.046)	(0.031)	(0.029)	(0.024)
SMB	0.147	0.222***	0.328***	0.232***	0.201***	0.172**	0.152**	0.068	−0.018	−0.231***
	(0.097)	(0.067)	(0.067)	(0.059)	(0.063)	(0.082)	(0.073)	(0.042)	(0.043)	(0.036)
HML	−0.236**	0.012	0.135***	0.017	0.161**	0.137	0.188***	0.108*	0.138***	−0.134***
	(0.104)	(0.069)	(0.051)	(0.073)	(0.073)	(0.085)	(0.040)	(0.056)	(0.047)	(0.046)
WML	−0.154*	0.006	−0.052	0.083	0.099	−0.003	0.068	0.069	−0.029	−0.007
	(0.092)	(0.047)	(0.044)	(0.064)	(0.067)	(0.044)	(0.061)	(0.049)	(0.043)	(0.042)
UMS	0.692***	0.360***	0.611***	0.056	0.091	−0.016	0.201**	0.039	0.006	−0.290***
	(0.165)	(0.060)	(0.079)	(0.083)	(0.106)	(0.070)	(0.089)	(0.069)	(0.083)	(0.049)
Constant	−0.001	0.001	0.00001	0.001	0.001	0.001	0.001	−0.001*	−0.0004	0.0002
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	99	101	99	97	98	99	99	98	99	99
Adjusted R^2	0.882***	0.953***	0.887***	0.927	0.926	0.937	0.924**	0.951	0.946	0.960***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from t-tests, and adjusted R^2 indications are from F-tests for nested models. Newey–West standard errors are reported in parentheses

Table 10 Vigeo Eiris North America: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.090***	1.085***	0.957***	1.031***	1.139***	1.040***	1.011***	1.105***	1.016***	1.035***
	(0.070)	(0.040)	(0.042)	(0.035)	(0.054)	(0.031)	(0.040)	(0.064)	(0.030)	(0.019)
SMB	0.127	0.109	0.157**	0.150**	0.133*	0.033	0.128**	−0.058	−0.140**	−0.282***
	(0.086)	(0.066)	(0.078)	(0.059)	(0.073)	(0.066)	(0.063)	(0.081)	(0.063)	(0.028)
HML	−0.223**	−0.089	−0.038	0.092	0.088	−0.011	0.172*	0.134	0.036	0.020
	(0.093)	(0.090)	(0.061)	(0.077)	(0.064)	(0.093)	(0.093)	(0.125)	(0.075)	(0.034)
WML	0.007	0.004	0.049	−0.034	0.106*	−0.041	−0.002	0.023	0.101*	−0.114***
	(0.101)	(0.070)	(0.048)	(0.037)	(0.056)	(0.047)	(0.072)	(0.071)	(0.052)	(0.028)
UMS	0.149**	−0.039	0.044	0.056	0.007	0.064*	−0.160***	−0.101*	0.037	−0.002
	(0.070)	(0.047)	(0.035)	(0.034)	(0.040)	(0.037)	(0.058)	(0.055)	(0.031)	(0.026)
Constant	−0.001	−0.0002	0.002	0.002	0.0002	0.001	−0.004**	−0.003**	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	64	57	61	62	54	58	56	58	56	56
Adjusted R^2	0.822**	0.916	0.904	0.939	0.887	0.902	0.893***	0.906**	0.902	0.951
Governance										
Market	1.048***	1.029***	1.116***	1.062***	1.011***	1.087***	1.039***	0.992***	1.002***	1.033***
	(0.100)	(0.035)	(0.054)	(0.034)	(0.051)	(0.042)	(0.049)	(0.039)	(0.053)	(0.037)
SMB	0.106	0.023	0.090	−0.033	−0.051	−0.048	−0.172**	−0.249***	0.047	0.038
	(0.083)	(0.080)	(0.085)	(0.052)	(0.072)	(0.055)	(0.070)	(0.067)	(0.081)	(0.060)
HML	−0.344***	−0.046	0.165**	−0.059	−0.053	−0.056	0.099	0.021	0.348***	0.085*
	(0.100)	(0.064)	(0.068)	(0.071)	(0.089)	(0.057)	(0.083)	(0.070)	(0.075)	(0.050)
WML	−0.176	−0.070	0.092*	−0.008	−0.036	0.066	0.047	−0.016	0.098	−0.033
	(0.121)	(0.051)	(0.053)	(0.049)	(0.065)	(0.064)	(0.048)	(0.069)	(0.079)	(0.045)
UMS	0.078	0.008	0.139	−0.011	−0.009	−0.053	0.048	−0.107**	−0.055	−0.097**
	(0.094)	(0.049)	(0.090)	(0.045)	(0.062)	(0.060)	(0.072)	(0.049)	(0.048)	(0.042)
Constant	−0.002	0.002	−0.002**	0.002**	−0.002	−0.001	0.001	0.002	−0.002	−0.001
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	63	61	56	56	59	58	57	57	59	56
Adjusted R^2	0.824	0.902	0.915**	0.919	0.838	0.908	0.916	0.882*	0.905	0.933*
Social										
Market	0.958***	1.141***	1.075***	1.103***	1.048***	1.117***	1.061***	1.023***	1.056***	0.933***
	(0.036)	(0.042)	(0.054)	(0.042)	(0.039)	(0.030)	(0.037)	(0.029)	(0.028)	(0.028)
SMB	0.229***	0.120*	−0.073	0.173**	−0.007	0.109**	0.0001	−0.067	−0.097**	−0.307***
	(0.070)	(0.069)	(0.087)	(0.087)	(0.063)	(0.055)	(0.066)	(0.048)	(0.045)	(0.046)
HML	0.056	−0.165**	−0.362***	−0.109**	0.031	0.225***	0.023	0.202***	0.119***	0.052
	(0.075)	(0.067)	(0.097)	(0.053)	(0.076)	(0.079)	(0.060)	(0.054)	(0.030)	(0.036)
WML	0.108	0.079	0.012	−0.050	−0.062	0.047	0.059	0.017	0.014	−0.096
	(0.069)	(0.109)	(0.087)	(0.066)	(0.042)	(0.058)	(0.055)	(0.048)	(0.055)	(0.059)
UMS	0.014	0.073**	0.073**	0.037	0.005	0.014	0.031*	0.016	−0.082***	−0.046**
	(0.029)	(0.034)	(0.033)	(0.029)	(0.037)	(0.025)	(0.019)	(0.024)	(0.025)	(0.023)
Constant	−0.001	0.003	0.002	0.002	−0.002	0.001	0.0001	0.001	−0.002**	−0.002*
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	62	59	56	59	59	57	58	59	56	57
Adjusted R^2	0.880	0.830	0.798	0.886	0.888	0.937	0.927	0.936	0.948***	0.929*
ES										
Market	1.109***	1.092***	0.939***	1.063***	1.046***	1.068***	1.140***	1.086***	1.009***	0.990***
	(0.048)	(0.059)	(0.048)	(0.041)	(0.053)	(0.030)	(0.077)	(0.038)	(0.023)	(0.017)

Table 10 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SMB	0.094	0.248***	0.116	0.103*	0.064	0.115**	0.076	−0.102*	−0.084*	−0.311***
	(0.100)	(0.066)	(0.071)	(0.060)	(0.077)	(0.052)	(0.091)	(0.061)	(0.051)	(0.037)
HML	−0.132	−0.146*	−0.058	0.095	−0.120	0.215***	−0.026	0.028	0.119***	0.071**
	(0.112)	(0.081)	(0.072)	(0.071)	(0.105)	(0.052)	(0.109)	(0.073)	(0.045)	(0.029)
WML	0.130	−0.120	0.050	0.014	0.011	−0.003	0.129	−0.062	0.061	−0.103***
	(0.096)	(0.087)	(0.068)	(0.058)	(0.055)	(0.059)	(0.080)	(0.068)	(0.039)	(0.029)
UMS	0.060	0.075	0.025	−0.001	0.022	0.008	−0.061	−0.001	0.024	−0.061**
	(0.058)	(0.048)	(0.039)	(0.029)	(0.035)	(0.035)	(0.042)	(0.050)	(0.044)	(0.025)
Constant	−0.001	−0.001	0.001	0.003***	0.0003	−0.0003	−0.003*	−0.0002	−0.0004	−0.0003
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Observations	63	69	55	62	63	56	58	52	56	49
Adjusted R^2	0.829	0.892	0.879	0.902	0.881	0.945	0.869	0.916	0.934	0.957**
ESG										
Market	1.098***	0.984***	0.997***	1.038***	1.049***	1.090***	1.124***	1.086***	1.016***	0.988***
	(0.056)	(0.033)	(0.050)	(0.040)	(0.054)	(0.035)	(0.055)	(0.029)	(0.031)	(0.021)
SMB	0.117	0.141**	0.160**	0.131**	0.024	0.003	0.159*	−0.042	−0.161***	−0.287***
	(0.080)	(0.062)	(0.074)	(0.061)	(0.092)	(0.061)	(0.093)	(0.056)	(0.045)	(0.041)
HML	−0.345***	−0.044	−0.049	0.148**	−0.144	0.049	0.092	−0.022	0.206***	0.061**
	(0.099)	(0.063)	(0.057)	(0.068)	(0.126)	(0.096)	(0.096)	(0.049)	(0.049)	(0.030)
WML	−0.084	0.100*	−0.044	0.101*	−0.014	0.017	0.011	0.029	0.040	−0.098**
	(0.107)	(0.054)	(0.051)	(0.053)	(0.068)	(0.056)	(0.077)	(0.059)	(0.060)	(0.039)
UMS	0.048	−0.011	−0.007	0.091**	0.018	−0.011	0.098	−0.110***	0.008	−0.057**
	(0.065)	(0.035)	(0.036)	(0.036)	(0.038)	(0.036)	(0.077)	(0.032)	(0.037)	(0.027)
Constant	−0.003	0.001	0.002*	0.001	−0.00001	−0.002	0.001	0.002	−0.001	−0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	70	63	56	56	58	56	55	56	58	54
Adjusted R^2	0.825	0.906	0.912	0.908**	0.841	0.897	0.885*	0.921**	0.936	0.946**

Table 11 ASSET4 Europe: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.034***	0.986***	1.113***	1.038***	1.052***	1.053***	1.030***	0.969***	0.992***	1.027***
	(0.022)	(0.031)	(0.030)	(0.023)	(0.033)	(0.016)	(0.018)	(0.021)	(0.017)	(0.013)
SMB	0.245***	0.533***	0.544***	0.292***	0.148**	−0.026	−0.112*	−0.090	−0.108	−0.137***
	(0.062)	(0.092)	(0.131)	(0.059)	(0.068)	(0.080)	(0.062)	(0.077)	(0.072)	(0.043)
HML	0.076	−0.088	−0.075	−0.213***	−0.038	−0.204***	0.082	0.008	0.155**	0.061
	(0.070)	(0.059)	(0.095)	(0.050)	(0.095)	(0.059)	(0.059)	(0.051)	(0.068)	(0.047)
WML	−0.033	−0.002	−0.0002	−0.068**	−0.114	−0.126***	−0.031	0.061*	0.082**	0.009
	(0.025)	(0.040)	(0.036)	(0.031)	(0.080)	(0.048)	(0.034)	(0.032)	(0.039)	(0.019)
UMS	0.180**	0.325***	0.247***	−0.045	0.257***	0.248***	0.017	−0.113*	−0.096*	−0.213***
	(0.072)	(0.067)	(0.072)	(0.075)	(0.076)	(0.063)	(0.070)	(0.063)	(0.058)	(0.044)
Constant	0.0003	0.0004	0.001	0.0003	0.001	0.001*	−0.001	0.001	−0.0002	0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	79	79	79	80	79	79	80	80	79
Adjusted R^2	0.960**	0.952***	0.955***	0.964	0.946***	0.964***	0.972	0.970**	0.977*	0.983***
Governance										
Market	1.048***	1.041***	1.044***	1.027***	1.036***	1.072***	1.059***	0.993***	1.054***	0.949***
	(0.016)	(0.020)	(0.024)	(0.019)	(0.019)	(0.029)	(0.027)	(0.013)	(0.036)	(0.015)
SMB	0.460***	0.040	0.075	−0.004	−0.003	0.025	−0.104*	−0.102***	−0.015	−0.143***
	(0.048)	(0.051)	(0.052)	(0.047)	(0.092)	(0.074)	(0.053)	(0.038)	(0.075)	(0.050)
HML	−0.127***	−0.030	−0.054	0.113*	0.008	0.073	0.016	0.065	0.013	0.037
	(0.033)	(0.037)	(0.056)	(0.059)	(0.075)	(0.060)	(0.067)	(0.051)	(0.052)	(0.037)
WML	−0.047	−0.010	0.034	0.119***	0.027	−0.004	0.041*	0.009	−0.095**	0.0001
	(0.035)	(0.029)	(0.028)	(0.022)	(0.025)	(0.057)	(0.024)	(0.023)	(0.039)	(0.019)
UMS	0.400***	0.277***	0.494***	0.084	0.131*	0.061	−0.143***	−0.146***	−0.097*	−0.323***
	(0.052)	(0.049)	(0.052)	(0.055)	(0.071)	(0.117)	(0.048)	(0.042)	(0.055)	(0.072)
Constant	−0.0004	0.001	0.002*	0.0001	−0.0002	0.0003	−0.002***	0.001*	0.0001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	80	79	79	80	79	79	80	79	80
Adjusted R^2	0.971***	0.969***	0.969***	0.969*	0.969**	0.959	0.963**	0.978***	0.964	0.974***
Social										
Market	1.084***	1.015***	1.070***	0.988***	1.034***	0.999***	1.022***	1.029***	1.013***	1.001***
	(0.038)	(0.029)	(0.030)	(0.022)	(0.044)	(0.020)	(0.023)	(0.021)	(0.017)	(0.020)
SMB	0.405***	0.351***	0.432***	0.350***	0.152	0.159*	0.077	0.003	−0.166***	−0.295***
	(0.071)	(0.062)	(0.112)	(0.076)	(0.097)	(0.085)	(0.075)	(0.083)	(0.054)	(0.054)
HML	−0.039	−0.042	−0.041	−0.078	−0.016	0.050	0.026	0.069	−0.057*	0.054
	(0.068)	(0.057)	(0.091)	(0.064)	(0.109)	(0.081)	(0.049)	(0.059)	(0.033)	(0.074)
WML	−0.085	0.040	−0.062*	0.037	−0.007	0.077***	0.013	0.074***	−0.044***	−0.008
	(0.075)	(0.037)	(0.037)	(0.033)	(0.056)	(0.029)	(0.032)	(0.019)	(0.017)	(0.027)
UMS	0.327***	0.307***	0.307***	0.220***	0.029	0.087	−0.063	−0.060	−0.109**	−0.209***
	(0.080)	(0.085)	(0.101)	(0.072)	(0.094)	(0.090)	(0.064)	(0.056)	(0.049)	(0.077)
Constant	0.001	−0.00004	−0.0003	0.002	−0.001	0.002*	−0.0003	0.0003	−0.0004	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	79	79	79	79	79	79	79	79	80

Table 11 (continued)

Decile	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Adjusted R^2	0.950***	0.952***	0.953***	0.955***	0.927	0.962	0.960	0.975	0.983**	0.973***
ES										
Market	1.033***	1.077***	1.079***	0.998***	1.053***	1.009***	1.008***	0.998***	1.047***	0.986***
	(0.022)	(0.026)	(0.036)	(0.021)	(0.032)	(0.033)	(0.022)	(0.021)	(0.016)	(0.014)
SMB	0.376***	0.407***	0.391***	0.408***	0.254***	0.086	0.117	−0.083	−0.091**	−0.269***
	(0.051)	(0.066)	(0.079)	(0.098)	(0.082)	(0.067)	(0.083)	(0.054)	(0.040)	(0.036)
HML	−0.029	−0.069	0.012	−0.160**	−0.177***	−0.057	0.064	0.118**	−0.051	0.087*
	(0.077)	(0.070)	(0.053)	(0.069)	(0.065)	(0.089)	(0.085)	(0.050)	(0.034)	(0.048)
WML	−0.026	−0.080**	−0.003	0.027	−0.055	−0.046	−0.027	0.103***	−0.038**	0.027
	(0.037)	(0.039)	(0.034)	(0.044)	(0.035)	(0.047)	(0.032)	(0.021)	(0.015)	(0.028)
UMS	0.331***	0.337***	0.089	0.121	0.108*	0.023	0.136	−0.123**	−0.178***	−0.099**
	(0.083)	(0.074)	(0.083)	(0.118)	(0.061)	(0.068)	(0.092)	(0.059)	(0.041)	(0.042)
Constant	0.001	−0.0003	−0.0001	−0.0001	0.0001	0.001	0.001	−0.001	0.0004	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	80	79	79	80	79	79	79	79	79
Adjusted R^2	0.950***	0.956***	0.964	0.937	0.961	0.942	0.963**	0.971**	0.985***	0.981**
ESG										
Market	1.052***	1.059***	1.017***	1.041***	1.102***	1.050***	1.020***	1.047***	1.037***	0.954***
	(0.022)	(0.023)	(0.032)	(0.020)	(0.042)	(0.027)	(0.037)	(0.015)	(0.012)	(0.012)
SMB	0.407***	0.376***	0.293***	0.321***	0.216***	0.153**	−0.025	−0.057	−0.114***	−0.217***
	(0.057)	(0.053)	(0.061)	(0.061)	(0.081)	(0.069)	(0.078)	(0.086)	(0.040)	(0.039)
HML	−0.094	0.027	−0.030	−0.106**	−0.274***	−0.099	0.162**	0.121*	0.062**	0.032
	(0.068)	(0.050)	(0.061)	(0.053)	(0.072)	(0.063)	(0.068)	(0.064)	(0.028)	(0.046)
WML	−0.043	−0.023	−0.017	−0.015	−0.037	−0.036	0.055*	0.105***	0.001	−0.021
	(0.052)	(0.033)	(0.046)	(0.038)	(0.065)	(0.028)	(0.028)	(0.022)	(0.033)	(0.017)
UMS	0.380***	0.172*	0.426***	0.023	−0.007	0.084	0.033	−0.191***	−0.024	−0.160***
	(0.075)	(0.094)	(0.092)	(0.075)	(0.108)	(0.072)	(0.055)	(0.071)	(0.054)	(0.048)
Constant	0.0004	−0.00000	−0.002	0.002	0.0002	0.0003	0.002	0.001	−0.001*	0.0003
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	79	79	79	79	79	79	80	79	79
Adjusted R^2	0.948***	0.961**	0.938***	0.956	0.942	0.961	0.965	0.964***	0.986	0.981***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from t-tests, and adjusted R^2 indications are from *F*-tests for nested models. Newey–West standard errors are reported in parentheses

Table 12 Refinitiv Europe: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	0.998***	1.048***	1.184***	1.054***	1.025***	1.028***	1.026***	1.030***	0.963***	1.014***
	(0.026)	(0.022)	(0.030)	(0.035)	(0.026)	(0.025)	(0.018)	(0.016)	(0.019)	(0.022)
SMB	0.213***	0.627***	0.384***	0.524***	0.213***	0.030	−0.111*	−0.104*	−0.074*	−0.203***
	(0.078)	(0.087)	(0.065)	(0.157)	(0.075)	(0.085)	(0.060)	(0.053)	(0.039)	(0.045)
HML	0.083	−0.106	−0.209***	−0.042	−0.212***	−0.060	0.102***	−0.069	−0.019	0.193***
	(0.061)	(0.067)	(0.075)	(0.105)	(0.065)	(0.041)	(0.038)	(0.048)	(0.041)	(0.050)
WML	−0.028	−0.018	−0.072*	−0.028	−0.175**	−0.026	0.060***	−0.003	0.073***	−0.003
	(0.032)	(0.029)	(0.038)	(0.039)	(0.088)	(0.025)	(0.017)	(0.040)	(0.024)	(0.041)
UMS	0.295***	0.262***	0.340***	0.076	0.149	0.168***	0.144***	−0.101**	−0.224***	−0.131**
	(0.098)	(0.091)	(0.091)	(0.147)	(0.092)	(0.062)	(0.045)	(0.042)	(0.031)	(0.053)
Constant	0.001	−0.0002	−0.001	−0.001	0.001	−0.00002	0.001	−0.0002	−0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	83	84	72	78	79	79	79	79	79	80
Adjusted R^2	0.947***	0.959***	0.945***	0.930	0.946*	0.966**	0.973**	0.972*	0.977***	0.980**
Governance										
Market	1.062***	1.021***	1.007***	1.059***	1.079***	1.020***	1.003***	1.033***	1.014***	0.964***
	(0.018)	(0.031)	(0.016)	(0.031)	(0.018)	(0.025)	(0.026)	(0.051)	(0.058)	(0.027)
SMB	0.198***	0.005	0.007	−0.129**	0.033	−0.192***	0.019	−0.067	−0.004	−0.099
	(0.048)	(0.064)	(0.050)	(0.062)	(0.055)	(0.064)	(0.056)	(0.085)	(0.108)	(0.070)
HML	−0.113**	−0.031	0.094**	0.095*	−0.139	0.064	0.134	0.035	−0.007	0.107***
	(0.051)	(0.046)	(0.043)	(0.049)	(0.089)	(0.060)	(0.086)	(0.057)	(0.057)	(0.041)
WML	−0.019	0.038	0.011	0.042*	−0.094***	−0.043*	0.037	0.058*	−0.063**	0.028
	(0.023)	(0.034)	(0.025)	(0.024)	(0.035)	(0.024)	(0.030)	(0.035)	(0.026)	(0.022)
UMS	0.490***	0.432***	0.283***	0.028	0.085	0.102*	−0.139*	−0.178***	−0.156***	−0.385***
	(0.078)	(0.085)	(0.060)	(0.085)	(0.080)	(0.059)	(0.083)	(0.048)	(0.053)	(0.063)
Constant	0.002*	−0.0004	−0.001	0.0005	0.0004	0.001	−0.0002	0.001	0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	83	83	83	83	83	83	83	83	83	83
Adjusted R^2	0.964***	0.964***	0.965***	0.956	0.955	0.967	0.959**	0.968***	0.961**	0.964***
Social										
Market	1.050***	0.992***	1.033***	1.089***	1.063***	1.020***	1.053***	1.029***	1.014***	0.973***
	(0.025)	(0.034)	(0.025)	(0.026)	(0.021)	(0.021)	(0.020)	(0.018)	(0.015)	(0.009)
SMB	0.420***	0.329***	0.076	0.206***	0.115**	0.079	0.011	0.063	−0.097**	−0.219***
	(0.067)	(0.068)	(0.060)	(0.078)	(0.046)	(0.110)	(0.067)	(0.065)	(0.040)	(0.028)
HML	0.073	0.057	−0.050	0.008	0.196***	0.322***	0.233***	0.159***	0.017	−0.171***
	(0.059)	(0.057)	(0.046)	(0.062)	(0.071)	(0.100)	(0.054)	(0.047)	(0.041)	(0.025)
WML	−0.012	−0.011	−0.070**	0.024	0.017	0.007	−0.044*	−0.032	−0.060**	0.083***
	(0.031)	(0.028)	(0.035)	(0.038)	(0.034)	(0.069)	(0.026)	(0.034)	(0.024)	(0.017)
UMS	0.307***	0.373***	0.317***	0.177	0.223***	0.138	0.186**	−0.085*	−0.114***	−0.236***
	(0.080)	(0.075)	(0.096)	(0.125)	(0.058)	(0.124)	(0.085)	(0.048)	(0.043)	(0.070)
Constant	0.001	0.001	−0.0003	0.001	0.0003	0.002*	0.0005	−0.0003	0.00003	−0.0003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	83	83	83	83	83	83	83	83	83	83
Adjusted R^2	0.964***	0.961***	0.955***	0.957**	0.966***	0.952	0.974***	0.976	0.982**	0.981***

Table 12 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ES										
Market	1.078***	1.082***	1.114***	1.036***	1.047***	1.046***	1.053***	1.071***	1.026***	0.987***
	(0.032)	(0.018)	(0.021)	(0.018)	(0.026)	(0.022)	(0.026)	(0.018)	(0.016)	(0.019)
SMB	0.345***	0.503***	0.302***	0.399***	0.275***	0.291***	0.213***	0.030	−0.119***	−0.268***
	(0.063)	(0.103)	(0.052)	(0.053)	(0.095)	(0.082)	(0.073)	(0.043)	(0.045)	(0.045)
HML	−0.049	−0.061	0.035	−0.087	−0.102	−0.004	0.042	0.163***	0.098	−0.053
	(0.080)	(0.065)	(0.094)	(0.066)	(0.070)	(0.082)	(0.084)	(0.049)	(0.063)	(0.042)
WML	−0.142***	−0.066	−0.025	−0.095*	−0.065	0.046	−0.004	0.041	−0.009	0.017
	(0.049)	(0.041)	(0.053)	(0.050)	(0.051)	(0.056)	(0.034)	(0.027)	(0.022)	(0.020)
UMS	0.426***	0.428***	0.429***	0.076	0.154	−0.037	0.030	−0.069	−0.046	−0.121***
	(0.098)	(0.128)	(0.055)	(0.071)	(0.103)	(0.054)	(0.058)	(0.066)	(0.057)	(0.044)
Constant	0.002*	0.0003	0.0002	0.0004	0.002	0.001	0.0005	−0.00004	−0.001**	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	80	79	79	79	79	79	79	80	79	80
Adjusted R^2	0.955***	0.955***	0.960***	0.959	0.960*	0.964	0.967	0.974	0.975	0.987***
ESG										
Market	1.018***	1.120***	1.116***	1.048***	1.053***	1.046***	1.056***	1.084***	1.009***	0.988***
	(0.023)	(0.038)	(0.021)	(0.021)	(0.025)	(0.019)	(0.020)	(0.039)	(0.016)	(0.015)
SMB	0.281***	0.489***	0.379***	0.415***	0.198**	0.253***	0.117	0.054	−0.125***	−0.238***
	(0.060)	(0.097)	(0.078)	(0.101)	(0.080)	(0.081)	(0.086)	(0.071)	(0.046)	(0.038)
HML	0.008	−0.044	−0.023	−0.058	0.012	−0.107*	0.018	0.096**	0.115*	−0.029
	(0.079)	(0.068)	(0.088)	(0.061)	(0.077)	(0.058)	(0.078)	(0.042)	(0.060)	(0.034)
WML	−0.128***	−0.009	−0.058	−0.048	−0.041	−0.027	0.069***	−0.009	0.014	0.011
	(0.045)	(0.042)	(0.041)	(0.059)	(0.041)	(0.026)	(0.024)	(0.025)	(0.023)	(0.014)
UMS	0.453***	0.386***	0.353***	0.148*	0.218**	−0.040	−0.024	0.011	−0.121**	−0.119**
	(0.156)	(0.113)	(0.098)	(0.076)	(0.095)	(0.107)	(0.091)	(0.077)	(0.051)	(0.047)
Constant	0.001*	0.001	−0.001	0.002	0.0005	0.001*	0.001	0.0002	−0.001	0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	83	77	78	79	79	79	79	79	79	80
Adjusted R^2	0.950***	0.956***	0.957***	0.953	0.957**	0.967	0.968	0.974	0.978**	0.989***

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG

*, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from t-tests, and adjusted R^2 indications are from F-tests for nested models. Newey–West standard errors are reported in parentheses

Table 13 Vigeo Eiris Europe: Carhart + UMS

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Environmental										
Market	1.003***	1.051***	1.000***	1.060***	0.982***	0.973***	1.027***	1.056***	1.031***	0.956***
	(0.036)	(0.038)	(0.032)	(0.020)	(0.014)	(0.023)	(0.031)	(0.043)	(0.046)	(0.029)
SMB	0.243***	0.148	0.231***	0.033	−0.016	−0.097	−0.054	−0.125	−0.078	−0.288***
	(0.057)	(0.121)	(0.079)	(0.078)	(0.081)	(0.093)	(0.125)	(0.083)	(0.080)	(0.092)
HML	−0.021	−0.131	−0.023	0.067	0.153***	0.143*	0.068	−0.093	0.135**	−0.013
	(0.074)	(0.091)	(0.061)	(0.076)	(0.058)	(0.083)	(0.053)	(0.071)	(0.067)	(0.049)
WML	0.047	−0.128	0.009	0.003	−0.008	0.074	0.095***	−0.078	0.110**	−0.114*
	(0.037)	(0.094)	(0.068)	(0.044)	(0.025)	(0.055)	(0.034)	(0.049)	(0.052)	(0.058)
UMS	0.116*	0.202***	0.180***	0.041	0.060	−0.068	0.042	0.011	−0.135***	−0.074
	(0.062)	(0.064)	(0.054)	(0.056)	(0.053)	(0.050)	(0.046)	(0.053)	(0.025)	(0.079)
Constant	0.001	0.001	−0.001	0.001	−0.001	0.001	−0.0004	−0.0003	−0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	66	63	58	64	62	63	62	60	59	58
Adjusted R^2	0.934**	0.928***	0.940***	0.950	0.961	0.952	0.951	0.966	0.959***	0.942
Governance										
Market	1.021***	1.042***	0.994***	1.010***	1.016***	0.986***	1.009***	1.044***	1.029***	0.983***
	(0.021)	(0.022)	(0.019)	(0.038)	(0.030)	(0.016)	(0.034)	(0.013)	(0.022)	(0.017)
SMB	0.171***	0.109	−0.029	−0.128	0.049	−0.196***	−0.108*	−0.147***	−0.089	−0.123**
	(0.050)	(0.069)	(0.051)	(0.089)	(0.097)	(0.056)	(0.059)	(0.054)	(0.061)	(0.060)
HML	−0.082	−0.073*	−0.135**	0.081	0.195**	0.083	0.131***	0.187***	0.061	−0.087**
	(0.053)	(0.041)	(0.053)	(0.125)	(0.078)	(0.099)	(0.049)	(0.065)	(0.054)	(0.036)
WML	−0.063	0.002	0.009	0.078*	0.112*	−0.035	0.048**	−0.046	0.014	−0.013
	(0.041)	(0.028)	(0.021)	(0.041)	(0.066)	(0.047)	(0.020)	(0.047)	(0.027)	(0.025)
UMS	0.305***	0.183***	0.368***	0.118*	0.145*	0.206***	0.043	−0.377***	−0.246***	−0.374***
	(0.052)	(0.055)	(0.067)	(0.068)	(0.088)	(0.068)	(0.057)	(0.069)	(0.055)	(0.058)
Constant	0.001	0.002*	−0.001	−0.00000	−0.0002	0.002*	−0.00004	−0.0002	−0.001	−0.0003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	64	62	62	62	62	62	61	62	59	60
Adjusted R^2	0.957***	0.966***	0.966***	0.950*	0.939**	0.958***	0.957	0.952***	0.968***	0.956***
Social										
Market	1.022***	1.044***	1.025***	1.019***	0.966***	0.992***	0.976***	1.062***	1.003***	1.005***
	(0.021)	(0.055)	(0.036)	(0.032)	(0.031)	(0.036)	(0.042)	(0.019)	(0.017)	(0.014)
SMB	0.486***	0.298***	0.057	0.133	−0.041	−0.002	−0.130*	−0.121**	−0.183***	−0.256***
	(0.070)	(0.104)	(0.060)	(0.087)	(0.101)	(0.124)	(0.079)	(0.060)	(0.046)	(0.044)
HML	0.112**	−0.178**	−0.065	−0.116*	−0.069	0.026	0.035	0.056	0.0003	0.195***
	(0.055)	(0.071)	(0.053)	(0.060)	(0.059)	(0.074)	(0.045)	(0.048)	(0.046)	(0.041)
WML	−0.061*	0.038	0.036	−0.035	−0.038	0.060*	0.095**	−0.005	0.031**	−0.028
	(0.035)	(0.046)	(0.031)	(0.029)	(0.036)	(0.033)	(0.040)	(0.027)	(0.016)	(0.022)
UMS	0.167***	0.281***	0.232***	0.053	0.026	0.065	−0.021	−0.018	−0.067	−0.168***
	(0.041)	(0.072)	(0.052)	(0.049)	(0.053)	(0.041)	(0.060)	(0.027)	(0.050)	(0.036)
Constant	0.002***	−0.002	0.002	0.001	0.001	−0.002	−0.001	0.001	0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	64	62	61	63	63	60	61	62	62	58
Adjusted R^2	0.963***	0.947***	0.950***	0.945	0.946	0.940	0.955	0.968	0.977*	0.981***

Table 13 (continued)

Decile										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ES										
Market	0.985***	1.036***	1.011***	1.111***	0.975***	0.933***	1.010***	1.049***	1.017***	0.990***
	(0.032)	(0.050)	(0.021)	(0.029)	(0.032)	(0.021)	(0.022)	(0.015)	(0.031)	(0.021)
SMB	0.328***	0.241**	0.322***	0.037	−0.061	0.069	−0.069	−0.129***	−0.137***	−0.280***
	(0.062)	(0.097)	(0.085)	(0.071)	(0.122)	(0.073)	(0.085)	(0.040)	(0.048)	(0.062)
HML	−0.043	−0.057	−0.082	−0.185***	0.273***	0.020	−0.068*	−0.008	0.114**	0.064
	(0.064)	(0.084)	(0.060)	(0.047)	(0.065)	(0.074)	(0.041)	(0.042)	(0.047)	(0.049)
WML	−0.005	−0.004	−0.014	−0.032	−0.062	0.111**	0.072***	0.009	0.049	−0.062
	(0.026)	(0.043)	(0.041)	(0.026)	(0.048)	(0.051)	(0.027)	(0.016)	(0.035)	(0.039)
UMS	0.166***	0.204**	0.078*	0.146***	0.004	0.019	0.024	−0.015	−0.111***	−0.114*
	(0.055)	(0.087)	(0.047)	(0.054)	(0.081)	(0.039)	(0.040)	(0.039)	(0.034)	(0.066)
Constant	0.001	0.001	0.001	0.001	−0.00002	0.0001	0.0003	−0.001	−0.0004	0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	65	63	65	63	61	63	59	59	58	59
Adjusted R^2	0.947***	0.930***	0.960*	0.960***	0.945	0.942	0.961	0.977	0.969***	0.962**
ESG										
Market	0.995***	1.047***	1.076***	1.051***	0.974***	0.992***	1.030***	0.992***	0.987***	1.021***
	(0.034)	(0.048)	(0.040)	(0.021)	(0.017)	(0.026)	(0.016)	(0.043)	(0.018)	(0.022)
SMB	0.351***	0.156	0.239***	0.018	0.086	−0.088	−0.090	−0.119*	−0.180***	−0.239***
	(0.067)	(0.111)	(0.072)	(0.067)	(0.099)	(0.115)	(0.071)	(0.070)	(0.048)	(0.076)
HML	−0.061	−0.077	−0.289***	−0.002	0.033	0.114	0.094**	0.031	0.102***	0.017
	(0.063)	(0.080)	(0.060)	(0.047)	(0.066)	(0.093)	(0.048)	(0.045)	(0.033)	(0.037)
WML	0.044	−0.017	−0.071**	0.010	−0.024	0.026	0.088**	0.063*	0.068***	−0.111*
	(0.029)	(0.033)	(0.031)	(0.036)	(0.042)	(0.033)	(0.039)	(0.038)	(0.017)	(0.057)
UMS	0.156***	0.240***	0.224***	0.185***	−0.044	−0.003	0.063	−0.132**	−0.038	−0.099
	(0.056)	(0.072)	(0.049)	(0.039)	(0.051)	(0.060)	(0.039)	(0.065)	(0.037)	(0.086)
Constant	−0.00003	0.001	0.002	0.001	0.0003	0.0003	−0.0001	−0.001	−0.0001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	67	65	63	57	62	65	57	61	61	57
Adjusted R^2	0.937***	0.947***	0.956***	0.961***	0.944	0.945	0.962	0.946**	0.977	0.962**

This table shows the regression results of value-weighted decile portfolios for five different ESG dimensions. The utilized model is the Carhart four-factor model with an additional UMS factor accounting for each dimension of ESG. *, ** and *** denote significance levels on the 10%, 5% and 1% significance levels, respectively. Significance level indications pertaining to the Carhart factors, UMS and constants are obtained from *t*-tests, and adjusted R^2 indications are from F-tests for nested models. Newey–West standard errors are reported in parentheses

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