ESG controversy as a risk factor

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Abstract

Recently, literature has explored the relationship between a firm's ESG (Environmental, Social, and Governance) activities and its performance, as well as conducted research on the performance of socially responsible investments. We examine whether ESG and ESG controversies can act as risk factors that systemically affects the return-risk relationship in the stock market. ESG controversies have a significant risk premium and significantly explain the cross-section under controlling well-known factors within the model whereas ESG does not.

Keywords: ESG; ESG controversies; Risk factor; Risk premia

JEL Classification Codes: G11, G12, M14

1. Introduction

Over the past few decades, as sustainable development has become an increasingly important issue in the business world, there has been a growing debate on how to establish relationships between stakeholders and companies. Companies are under pressure to demonstrate their ESG performance to governments, institutions, investors, consumers, and others, taking an interest in environmental, social, and governance (ESG) activities. With the rise of ESG investment, the integration of ESG information into asset management has also been actively discussed in the financial market. According to Kim, Muhn, and Nikolaev (2023), the proportion of ESG information appearing in conference calls, as measured by ChatGPT, has increased to 43.7% in 2020, almost twice as much as in 2009. Also, the

number of UN PRI signatories increased by about 4.3 times compared to 10 years ago to 3,826 in 2021, and AUM increased by about 5.1 times to $121.3 trillion.

The relationship between ESG, or corporate social responsibility (CSR) which is traditionally addressed overall, and financial performance has been the subject of extensive research under the change of market participants and investors' perceptions (Gillan, Koch, and Starks, 2021). Some argue ESG hinders firms' profit maximization, but if ESG promotes a positive relationship between the firm and stakeholders and prevents damage from short-termism, the firm can avoid the risk associated with a decrease in the firm's profitability or viability, leading to long-term outperformance (Bénabou and Tirole, 2010). Orlitzky, Schmidt, and Rynes (2003) criticize the conventional trade-off perspective, stating that a meta-analysis of 52 studies over about 30 years shows that a positive correlation between a firm's social performance and financial performance can exist.

The debate on the relationship between ESG and financial performance has led to discussions on whether socially responsible investment (SRI), which considers sustainability, climate change, and CSR in investment decision-making, is more profitable than traditional investing. Kempf and Osthoff (2007) find that CSR is an important consideration in the stock market and that a portfolio of buying high CSR firms and selling low CSR firms shows a significant positive abnormal return. On the other hand, Brammer, Brooks, and Pavelin (2006) find that low expected returns are observed for firms with higher CSR performance, while Hamilton, Jo, and Statman (1993), Kreander et al. (2005), and Halbritter and Dorfleitner (2015) insist that portfolios constructed from CSR or ESG do not show significant outperformance. As the discussion of the effectiveness of SRI or the performance of ESG portfolios has accumulated, studies have also been conducted to abridge and synthesize them (Renneboog, Ter Horst, and Zhang, 2008; Revelli and Viviani, 2015; Widyawati, 2020). These mixed or conflicting results from studies on the performance of ESG investments mean that the decision-making of market participants surrounding ESG is complicated to comprehend.

In this vein, as research on ESG investment progresses, discussions on whether ESG can be a risk factor to systematically approach the relationship between ESG and the financial market based on the asset pricing theory have recently come into the spotlight (Lioui, 2018; Maiti, 2021). Since Fama and French (1992), research on potential risk factors that can explain the stock market has been conducted, and the interest in identifying risk factors has been intense, with hundreds of factors emerging (Hou, Xue, and Zhang, 2020). As the one of theoretical origins of observed premia in the stock market is compensation for taking a certain risk, it is necessary to clarify the relationship between return and risk to figure out if ESG can be a risk factor (Cornell, 2021). Companies that concentrate on ESG activities, which investors prefer, can enjoy a low cost of capital which is closely related to low expected returns (Heinkel, Kraus, and Zechner, 2001).

ESG activities have a close relationship with various risks regarding corporate operations and practices. Companies can face environmental risks from causing fines or damaging reputations by polluting the environment. It can also encounter high and unexpected regulatory and cleanup costs for the climate crisis and risk from failure to respond to appropriate resource and supply chain management in the long run. Furthermore, there are social risks in relationships with consumers, employees, and communities. Firms can suffer "voices" and boycotts from consumers due to corporate irresponsible behaviors, and harmful products, and corporate value can be damaged by resistance and strikes by employees due to unfair labor practices and policies. Lastly, in the case of governance related to the relationship with shareholders, inappropriate supervision of the board of directors, unequal structure in shareholder participation, and even criminal acts such as corruption or embezzlement can undermine shareholder trust. Given the risk-return relationship, investors who bear these ESG-related risks may demand more returns.

We contribute to the existing literature by expanding the scope beyond ESG and incorporating ESG controversies as well. We revolve around whether ESG and ESG controversies are risk factors and examine the systemic relationship between ESG and stock returns. To achieve this, we construct portfolios based on Refinitiv ESG scores and ESG controversies scores. We then test whether pricing errors are embedded within these mimicking portfolios, examine factor loadings of ESG and ESG controversies in covariance form, and investigate the significance of their risk premia in Fama-MacBeth regression. This research aims to explore the potential of those characteristics as risk factors and broaden our understanding in this area. Although there have been attempts at theoretical discussions and empirical analyses on whether ESG or CSR can be a risk factor, to our best knowledge, there have been no studies that examine them from the perspective of controversies as an alternative lens.

Our empirical results support that ESG controversy is a risk factor, while ESG is not. Thus, we propose that an ESG-related factor that aligns with the existing theoretical framework is not ESG but ESG controversy. If the ESG score focuses on how much a company is engaged in activities that enhance its relationship with stakeholders in terms of environmental, social, and governance aspects, then the ESG controversies score captures negative events that worsen the relationship between the company and stakeholders (Aouadi and Marsat, 2018). The ambiguity and subjectivity of ESG measures may have failed to produce significant results for ESG. It is difficult to assume that there is sufficient consensus among vendors regarding the definition and attributes of ESG (Billio et al., 2021), and the low transparency and high dispersion of ESG scores and ratings can undermine market participants' trust in ESG metrics (Widyawati, 2020). From these perspectives, it is more likely that risk-return relationships will appear in channels where investors are impressed by anecdotes such as ESG controversies that are well captured and countable in the media and where they want to avoid problematic companies, rather than in channels where they perceive ESG activities as mitigating risk.

This paper is organized as follows. Section 2 describes the literature on ESG as a risk factor theoretically and empirically. Section 3 explains how to construct portfolios and obtain data used in our analysis and describes methodologies to study whether ESG and ESG controversies are risk factors. Section 4 shows our empirical results. Section 5 concludes.

2. Literature review

First, some papers conduct theoretical analyses to determine whether ESG can be systematically priced in the market. Heinkel, Kraus, and Zechner (2001) conduct a theoretical study on the presence of investors who consider greenness in the market, referring to them as "green investors." Green investors prefer companies with green production technologies and are reluctant to invest in brown firms. As a result, brown firms face higher costs of capital compared to green firms. The authors also suggest that if there are enough green investors in the market, brown firms willingly invest in the costs associated with transforming into green firms, increasing the proportion of green firms in the market long-term. According to Fama and French (2007), if investors' preferences for socially responsible companies are reflected in the choices of their portfolios, this can be theoretically considered similar to a type of special belief held by investors, resulting in a lower expected return on CSR assets in equilibrium. Pástor, Stambaugh, and Taylor (2021) introduce a preference for ESG assets directly into investors' utility functions, claiming that companies with high ESG performance have lower costs of capital due to ESG-preferring investors, and as a result, the CAPM alpha can be negative, and the ESG factor has a negative risk premium. However, they argue that the expected return can temporarily increase if unexpected positive shocks affect the ESG factor. Pedersen, Fitzgibbons, and Pomorski (2021) divide investors into three types: ESG-unaware, aware, and motivated. They demonstrate how the expected return of high-ESG-scoring companies can change depending on the proportion of different investor types. When there are many ESG-unaware investors, the ESG-adjusted CAPM alpha can be positive, but when there are many ESG-motivated investors, the alpha can be negative. The above studies emphasize that due to investors' preferences and choices tilting to ESG, ESG asset prices in equilibrium is higher than traditional ones, leading to lower expected returns and lower capital costs.

Second, empirical studies analyzing whether ESG is a risk factor in the actual market are as follows. Lioui (2018) reports that ESG is priced in the market but not robustly, while the risk premium of the environmental factor is consistently significant. Meanwhile, Husse and Pippo (2021) report that by incorporating size control in portfolio construction, there are insignificant risk premia in certain multiple-factor models, leading to mixed results. Naffa and Fain (2022) also observe insignificant ESG alpha, while the environmental factor shows significant alpha. In addition, Pedersen, Fitzgibbons, and Pomorski (2021) find that the governance factor, which means low accruals, has a positive and

significant alpha, while the ESG factor as constructed using MSCI database is not significant. Contrastingly, Maiti (2021) asserts that a model composed of market, size, and ESG factors explains better compared to Fama French 3-factor model aimed at firms in the STOXX Europe 600 from 2010 to 2018, suggesting that ESG plays an important role in predicting stock returns. Becchetti, Ciciretti, and Dalò (2018) argue that companies with low CSR scores pay a risk premium based on their finding that domain-specific CSR risk factors partially capture pricing anomalies. This string of studies demonstrates a variety of perspectives and outcomes regarding the significance of the ESG factor and risk premium.

3. Data and methodology

3.1. ESG data and test portfolios

ESG scores are essential in constructing ESG portfolios. We use Refinitiv ESG scores which represent quantitatively a company's activities and performance regarding ESG, and ESG controversies scores which represent quantitatively issues or concerns surrounding ESG within the company. The ESG score data consists of three pillars (Environmental, Social, and Governance) and ten themes such as emissions, human rights, management, and so on. Refinitiv ESG scores cover over 80% of global market capitalization and measure how a company's ESG activities are being carried out by collecting data from public disclosures, websites, NGO reports, news data, and more. When calculating the ESG score, they also consider the industry the company belongs to and the availability of important data. ESG and ESG controversies scores are measured on a scale of 0 to 100. The higher the score, the more the company is considered an ESG leader, while a score closer to 0 indicates the company is an ESG laggard. In particular, Refinitiv tries to control a size bias by weighting the score differently depending on a firm size, considering that the media spotlight may differ contingent on the size.

We also obtain firms' stock price and market value data from Refinitiv Datastream. Our focus is on the US stock market such as NYSE, AMEX, and NASDAQ. The ESG dataset covers 5,598 firms including inactive firms which are delisted from the market to control survivorship bias. We use each firm's ESG and ESG controversies score from 2002 to 2021, and use 222 months of return and market value data from July 2003 to December 2021 for factor construction.

We utilize 1,853 anomaly portfolios provided by Hou, Xue, and Zhang (2020) as test portfolios, unlike previous literature (Husse and Pippo, 2021; Maiti, 2021) which use only a small number of test portfolios to verify whether ESG is a risk factor. They point out the replication issue within the asset

pricing research area and afford large-scale portfolio data for 188 anomalies.[1] It is important to consider a balance between individual stocks and a small number of portfolios because portfolios used in the analysis can significantly affect the outcomes of the asset price model (Feng, Giglio, and Xiu, 2020; Lewellen, Nagel, and Shanken, 2010)

3.2. Factor construction

In general, there are two ways to calculate factor return: value-weighted and equal-weighted portfolios. In our study, we construct value-weighted portfolios in the spirit of Fama and French (2008). They argue that more than half of anomalies are not significantly correlated in single tests due to the over-representation of microcaps, which have a vast number of stocks in the total market but account for a very small portion of the total market capitalization and are thus more prone to bias caused by outliers. Many studies have also supported the use of value-weighted portfolios (Hou, Xue, and Zhang, 2020; Feng, Giglio, and Xiu, 2020).

We calculate one-way ESG and ESG controversy factors using the aforementioned ESG score and ESG controversies score. The firms are sorted into terciles by ESG scores and are sorted whether ESG controversies scores are 100 points or not because companies with a score of 100 points account for more than half of the total. Using this sorting manner, we obtain 3 value-weighted ESG portfolios and 2 value-weighted ESG controversy portfolios. Then, we construct long-short portfolios as the difference between the highest-scoring portfolio and the lowest-scoring portfolio. We refer to our ESG factor and ESG controversy factor as *ESG* and *ESGC*, respectively, and collectively refer to them as ESG-related factors in this paper. Regarding the rebalancing timing, the scores are sorted based on December of year t and calculate the factor returns using the monthly stock returns of each firm from July of year t+1 to June of year t+2. When constructing our value-weighted portfolios, we use the market capitalization as of the end of the previous month. We employ the method to avoid look-ahead bias in line with CSR and ESG-related publications such as Husse and Pippo (2021), Galema, Plantinga, and Scholtens (2008), and Lee, Fan, and Wong (2021), as well as various factor search studies including Fama and French (1992).

3.3. Methodologies and benchmarks

Before assessing the validity of ESG-related factors, we first test whether our long-short portfolios have significant alphas. The specification to test this is as below:

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[1] https://global-q.org/testingportfolios.html

$$ESGs_t = \alpha + X\gamma + \varepsilon_t \quad \text{where } ESGs = \{ESG, ESGC\}, \tag{1}$$

We use control variable set, X, from CAPM, Fama French 3-factor model (hereafter FF3; Fama and French, 1992), Carhart 4-factor model (hereafter C4; Carhart, 1997), Fama French 5-factor model (hereafter FF5; Fama and French, 2015), q-factor model (Hou, Xue, and Zhang, 2015). The control factors and their coefficients used in each model are as follows.

FF3: $\gamma_1 MKT_t + \gamma_2 SMB_t + \gamma_3 HML_t$

C4: $\gamma_1 MKT_t + \gamma_2 SMB_t + \gamma_3 HML_t + \gamma_4 MOM_t$

FF5: $\gamma_1 MKT_t + \gamma_2 SMB_t + \gamma_3 HML_t + \gamma_4 RMW_t + \gamma_5 CMA_t$

q-factor: $\gamma_1 MKT_t + \gamma_2 SMB_t + \gamma_3 IA_t + \gamma_4 ROE_t$

In the models, *MKT* indicates the market excess return (i.e., $R_{m,t} - R_{f,t}$) and $R_{f,t}$ is the risk-free rate captured by the one-month Treasury bill rate, *SMB* is the size factor (small-minus-big), and *HML* is the value factor (high minus low book-to-market ratio). *MOM* is the momentum factor following Jegadeesh and Titman (1993). *RMW* is the profitability factor (robust-minus-weak), and *CMA* is the investment factor (conservative-minus-aggressive). In the q-factor model proposed by Hou, Xue, and Zhang (2015), *IA* is the investment factor (low versus high), and *ROE* is the profitability factor (high versus low). We estimate the regression model using the Newey-West estimator with max-lag 6 to attain efficient estimators.

Next, we test whether ESG-related factors are risk factors maneuvering two approaches. One is to measure covariance betas of ESG-related factors and the other is to measure risk premia of ESG-related factors by Fama-MacBeth regression (Fama and MacBeth, 1973; Lioui, 2018). The purpose of the first one is whether the factors explain the cross-section of expected return well, and the approach focuses on the significance of factor loading (see Kan, Robotti, and Shanken (2013)). This approach sets the excess return of test portfolios as the dependent variable and the covariance between portfolio return and factor return as the independent variable. The specification of the covariance approach is as below:

$$ER_i = \alpha + \lambda_{ESGs} C_{ESGs} + \Lambda \mathbb{C} \quad \text{where } ESGs = \{ESG, ESGC\}, \tag{2}$$

ER_i means the mean of each test portfolio, α indicates constant, C_{ESGs} indicates covariance vector between returns of test portfolios and an ESG-related factor, λ_{ESGs} indicates the coefficient of C_{ESGs} and it interprets as the ESG-related factor's loading, $\mathbb{C}$ indicates the covariance matrix between returns of test portfolios and control factors, and Λ means control factors' loadings. Control factor sets correspond to the sets in the analysis of pricing anomalies, which are equal to CAPM, FF3, C4, FF5, and q-factor. We estimate the regression model using the Newey-West estimator with max-lag 6 to attain efficient estimators. We estimate the regression model using the Newey-West estimator with max-lag 6.

The second approach, Fama-Macbeth regression, consists of two stages of estimation. First, a time-series regression is conducted on the test portfolios, followed by a cross-sectional regression. In the second stage, the risk premia are measured based on the factor exposure measured in the first stage, and it is used to infer how risk compensation occurs. Halbritter and Dorfleitner (2015) suggest that cross-sectional regression can provide a more in-depth understanding of how ESG levels affect cross-sectional returns. The specification of Fama-MacBeth regression is as below:

$$ER_i = \gamma_0 + \gamma_{ESGs}\widehat{\beta_{ESGs}} + \Gamma\hat{B} \quad \text{where} \quad ESGs = \{ESG, ESGC\}, \tag{3}$$

ER_i means the mean of each test portfolio, γ_0 indicates constant, $\widehat{\beta_{ESGs}}$ indicates an ESG-related factor's exposure estimated in the first stage, γ_{ESGs} indicates an ESG-related factor's risk premium, $\hat{B}$ indicates control factors' exposure vectors estimated in the first stage, and Γ indicates control factors' risk premia. Control factor sets correspond to the sets in the analysis of pricing anomalies, which are equal to CAPM, FF3, C4, FF5, and q-factor. We estimate the regression model using the Newey-West estimator with max-lag 6.

The data sources for the factors are as follows: $R_{f,t}$, *SMB*, *HML*, *RMW*, and *CMA* are obtained from the Kenneth R. French homepage.[2] *MOM* was obtained from Jensen, Kelly, and Pedersen's database[3], while *MKT*, *IA*, and *ROE* were obtained from the factor database of Hou, Xue, and Zhang, which was mentioned earlier.

4. Results

4.1. Summary statistics

Table 1 presents summary statistics for the factors used in our analysis from July 2003 to December 2021, with 222 observations. The returns in Table 1 are measured in percentage, and the means (standard deviations) for *ESG* and *ESGC* are 0.031% (2.074) and -0.038% (1.345), respectively.

[Table 1 about here]

Figure 1 shows the trend of cumulative returns for ESG-related factors with 222 observations. Interestingly, *ESG* showed an upward trend until 2010 but has been declining after 2010, while *ESGC*

[2] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html

[3] Jensen, Kelly, and Pedersen (2021) stress the replication issues in the asset pricing literature and provide replication data of hundreds of factors that have been introduced previously on their website. https://jkpfactors.com/.

has shown a stable downward trend under the lower variance, consistent with the summary statistics presented above.

[Figure 1 about here]

Table 2 shows the correlation between the factors used in the analysis. Both *IA* in q-factor and *RMW* in FF5, which mean the investment factor, show a high correlation of approximately 0.9. However, *ROE* in q-factor and *RMW* in FF5, both of which are based on profitability, are relatively lower correlated than the investment factor (correlation coefficient is 0.534). *ESG* has a correlation coefficient of -0.455 with *SMB* and 0.376 with *ROE*, while *ESGC* has a correlation coefficient of 0.531 with *SMB* and -0.451 with *ESG*.

[Table 2 about here]

4.2. Pricing anomalies

First, we examine whether ESG-related factors exhibit the characteristics of pricing anomalies that cannot be explained by well-known factor models. Regression was performed with ESG-related factor returns as the dependent variable and *MKT*, *SMB*, *HML*, *MOM*, *RMW*, *CMA*, *IA*, and *ROE* as the independent variables in Eq. (1). The results are shown in Table 3. Panel A of Table 3 represents the significance of α (constant) and the coefficients of control factors. α is not significant at the 10% level in all factor models for *ESG*. Therefore, the factor *ESG*, which mimics ESG risk, is unlikely to be an anomaly. The alpha of the factor that mimics ESG risk not being significant is consistent with the findings of Husse and Pippo (2021) and Naffa and Fain (2022). However, as shown in Panels B of Table 3, *ESGC* has a significant negative constant at the 5% level even with all of the control models, supporting that *ESGC* can be interpreted as an anomaly. The result that the constants have robustly negative values means that leading to lower returns when a firm is tangled less in ESG controversies. In model (1) of Panel A which indicates regression by CAPM, the beta loading has a negative value consistent with Husse and Pippo (2021). Meanwhile, in model (1) of Panel B, the beta loading has a positive value.

[Table 3 about here]

4.3. Factor loadings in the covariance form

In this section, as suggested in Eq. (2), we investigate whether ESG-related factors have significant loadings when *ESG* and *ESGC* are added to the existing factor model in the covariance form. For *ESG*, it shows a significant negative value at the 1% level in CAPM, and a significant positive value at the 1% level in FF3, C4, and FF5 (Panel A in Table 4). However, it has an insignificant loading at the 10% level in the q-factor model. Therefore, when using the ESG score, divergent results arise depending on which factor model is used as the control. In contrast, the coefficients of *ESGC* have significant negative values for all control factor sets (Panel B in Table 4). Among them, the significance is the highest when using the q-factor model as the control model (-9.37), followed by CAPM (-7.7). Non-pecuniary components such as ESG controversies can possess unique characteristics that distinguish them from traditional financial factors such as investment, profitability, liquidity, and so on. Therefore, it is necessary to explore the possibility that ESG controversies provide a new dimension that is conducive to explaining the variation of returns.

[Table 4 about here]

In terms of explanatory power, the R^2 of factor models with ESG-related factors added are larger than those of factor models used as controls. The original CAPM R^2 is 0.002, but with the additions of ESG and ESGC, the R^2 increase to 0.018 and 0.063, respectively. For FF3, the R^2 of 0.115 increases to 0.136 and 0.155 with the additions of ESG and ESGC. For C4, the R^2 increases from 0.115 to 0.136 and 0.155. The result that *MOM* has less explanatory power for the cross-section aligns with that there is no meaningful difference in R^2 between C4 and FF3 in all cases. For FF5, the R^2 of 0.229 increases to 0.235 and 0.256 with the additions of ESG and ESGC. For the q-factor model, the R^2 change from 0.112 to 0.112 and 0.189. The result that *ESG* is not significant in the q-factor model is consistent with the finding that R^2 is almost the same as that of the model without *ESG*.

4.4. Fama-MacBeth regression

Next, in this section, we report the results of Fama-MacBeth regression to probe the existence of risk premia for ESG-related factors. For *ESG* (shown as Panel A in Table 5), similar to the factor loading results from the covariance approach in Table 4, it has a significant negative value at the 1% level when CAPM is used as the control, but has significant positive values at the 1% level when FF3 and C4 are used as controls. With FF5 and q-factor, where investment and profitability are considered together, the risk premium is not significant at the 10% level. Therefore, *ESG* can be interpreted as not having a consistent risk premium. On the other hand, the risk premium of *ESG* (shown as Panel B in Table 5) has significant negative values at the 1% level for all of the control sets. Hence, the result supports

ESGC has a risk premium.

[Table 5 about here]

5. Conclusion

Previous studies have focused on whether ESG is a risk factor that entails a risk premium. However, many empirical analyses do not produce robust and significant findings to support this claim. Therefore, this paper shifts the focus to ESG controversies and examines whether they can explain stock returns and whether there is compensation for risk in the market through factor loading in the covariance form and the risk premium coefficient in the Fama-MacBeth regression. The findings suggest that ESG is not likely to be a risk factor, whereas ESG controversy is a candidate as a risk factor. This indicates that investors' perception and preference of ESG relate to corporate behaviors that may worsen ESG rather than ESG activities. Our study empirically demonstrates that a facet of ESG has a significant influence on the complex interplay between ESG and the financial market. Therefore, it is crucial to recognize the impact of ESG controversies that may deteriorate the relationship with stakeholders, including the environment, local communities, customers, employees, and shareholders, and how they are perceived by market participants.

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Table 1. Summary statistics of factors

	MKT	SMB	HML	MOM	RMW
obs.	222	222	222	222	222
mean	0.905	0.122	-0.104	0.074	0.305
median	1.380	0.135	-0.225	0.325	0.270
std	4.238	2.553	2.867	3.890	1.823
	CMA	IA	ROE	ESG	ESGC
obs.	222	222	222	222	222
mean	0.022	-0.006	0.237	0.031	-0.038
median	-0.050	-0.196	0.448	-0.107	-0.005
std	1.546	1.729	2.493	2.074	1.345

Note. This table shows the summary statistics of factors utilized in our setting. The samples span from Jul 2003 to Dec 2021. ESG and ESGC are collected from Refinitv Datastream.

Table 2. Correlation matrix between factors

	MktRF	SMB	HML	MOM	RMW	CMA	IA	ROE	ESG	ESGC
MktRF	1									
SMB	0.408	1								
HML	0.241	0.340	1							
MOM	-0.324	-0.209	-0.437	1						
RMW	-0.234	-0.392	-0.029	-0.004	1					
CMA	-0.069	0.118	0.471	-0.113	-0.016	1				
IA	-0.045	0.173	0.512	-0.192	-0.035	0.899	1			
ROE	-0.452	-0.533	-0.274	0.518	0.534	-0.028	-0.108	1		
ESG	-0.200	-0.455	0.137	-0.047	0.329	0.288	0.214	0.376	1	
ESGC	0.297	0.531	0.103	-0.103	-0.260	-0.104	-0.089	-0.325	-0.451	1

Note. This table shows pairwise correlations between factors from Jul 2003 to Dec 2021. *ESG* and *ESGC* are calculated from Refinitv Datastream ESG and ESG controversies score.

Table 3. Pricing anomalies

Panel A. ESG

	(1)	(2)	(3)	(4)	(5)
α	0.022	0.039	0.044	-0.069	-0.104
	(0.15)	(0.29)	(0.33)	(-0.51)	(-0.8)
MKT	-0.094***	-0.025	-0.031	0.009	0.047
	(-2.62)	(-0.7)	(-0.83)	(0.23)	(1.21)
SMB		-0.441***	-0.44***	-0.398***	-0.346***
		(-7.54)	(-7.54)	(-7.52)	(-6.93)
HML		0.242***	0.229***	0.129***	
		(5.91)	(6.02)	(3.25)	
MOM			-0.025		
			(-0.8)		
RMW				0.172	
				(1.44)	
CMA				0.359***	
				(3.75)	
IA					0.381***
					(4.87)
ROE					0.184**
					(2.15)
F-statistics	6.876***	22.07***	16.76***	17.29***	17.75***
$adj\ R^2$	0.038	0.296	0.294	0.361	0.317

Panel B. ESGC

	(1)	(2)	(3)	(4)	(5)
α	-0.221**	-0.205**	-0.204**	-0.178**	-0.18**
	(-2.49)	(-2.439)	(-2.43)	(-2.09)	(-2.26)
MKT	0.098***	0.037	0.037	0.027	0.022
	(3.17)	(1.10)	(1.08)	(0.8)	(0.7)
SMB		0.276***	0.277***	0.27***	0.272***
		(7.843)	(7.9)	(7.43)	(6.2)
HML		-0.0477	-0.049	-0.01	
		(-1.072)	(-1.02)	(-0.18)	
MOM			-0.003		
			(-0.16)		
RMW				-0.03	
				(-0.56)	
CMA				-0.128*	
				(-1.92)	
IA					-0.137***
					(-3.18)
ROE					-0.025
					(-0.59)
F-statistics	10.03***	26.41***	20.33***	17.38***	21.65***
$adj\ R^2$	0.088	0.290	0.287	0.300	0.308

Note. This table represents the results of testing pricing anomalies of *ESG* and *ESGC* with the Newey-West estimator (max-lag 6). Panel A shows the regression results of *ESG*, which is calculated by subtracting the return of the 1st tercile from that of the 3rd tercile, after sorting by Refinitiv ESG score.

Panel B shows the regression results of *ESGC*, which is calculated by subtracting the return of non-100 pts from that of 100 pts based on Refinitiv ESG controversies score, as the dependent variables. For each Panel, models (1), (2), (3), (4), and (5) correspond to CAPM, FF3, C4, FF5, and q-factor as the control factor model. $adj\ R^2$ refers to adjusted R-squared. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

Table 4. Covariance approach

Panel A. ESG

	(1)	(2)	(3)	(4)	(5)
α	1.074***	0.693***	0.719***	0.651***	0.67***
	(22.79)	(12.01)	(11.03)	(11.95)	(9.71)
ESG	-0.039***	0.089***	0.089***	0.054***	-0.01
	(-4.14)	(4.95)	(4.97)	(2.58)	(-0.59)
MKT	-0.01***	0.02***	0.018***	0.023***	0.024***
	(-2.93)	(4.19)	(3.12)	(4.61)	(3.68)
SMB		0.055***	0.056***	0.114***	0.019*
		(4.63)	(4.55)	(8.14)	(1.65)
HML		-0.064***	-0.067***	-0.108***	
		(-9.1)	(-7.95)	(-13.6)	
MOM			-0.003		
			(-0.76)		
RMW				0.137***	
				(8.8)	
CMA				0.034**	
				(2.35)	
IA					-0.034**
					(-2.31)
ROE					0.05***
					(5.49)
F-statistics	8.84***	39.40***	31.36***	53.51***	26.22***
$adj\ R^2$	0.018	0.136	0.136	0.235	0.112

Panel B. ESGC

	(1)	(2)	(3)	(4)	(5)
α	0.622***	0.76***	0.739***	0.711***	0.608***
	(12.62)	(14.39)	(11.36)	(13.08)	(9.44)
ESGC	-0.132***	-0.143***	-0.145***	-0.127***	-0.204***
	(-7.7)	(-6.72)	(-6.83)	(-5.7)	(-9.37)
MKT	0.033***	0.02***	0.022***	0.021***	0.032***
	(7.78)	(4.44)	(3.82)	(4.35)	(5.38)
SMB		0.045***	0.044***	0.12***	0.092***
		(4.48)	(4.28)	(9.25)	(7.48)
HML		-0.037***	-0.034***	-0.084***	
		(-9.76)	(-5.99)	(-11.44)	
MOM			0.002		
			(0.55)		
RMW				0.135***	
				(9.28)	
CMA				0.015	
				(1.12)	
IA					-0.058***
					(-7.48)
ROE					0.056***
					(7.04)
F-statistics	31.55***	41.65***	34.02***	50.73***	49.56***
$adj\ R^2$	0.063	0.155	0.155	0.256	0.189

Note. This table represents the results of covariance approach estimation for *ESG* and *ESGC* with the Newey-West estimator (max-lag 6). Panel A shows the regression results of *ESG*, which is calculated by subtracting the return of the 1st tercile from that of the 3rd tercile, after sorting by Refinitiv ESG score. Panel B shows the regression results of *ESGC*, which is calculated by subtracting the return of non-100 pts from that of 100 pts based on Refinitiv ESG controversies score, as the dependent variables. For each Panel, models (1), (2), (3), (4), and (5) correspond to CAPM, FF3, C4, FF5, and q-factor as the control factor model. $adj\ R^2$ refers to adjusted R-squared. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

Table 5. Fama-MacBeth regression

Panel A. ESG

	(1)	(2)	(3)	(4)	(5)
α	1.074***	0.693***	0.719***	0.651***	0.67***
	(22.79)	(12.0)	(11.03)	(11.94)	(9.71)
ESG	-0.152***	0.166***	0.162***	0.032	-0.06
	(-4.19)	(3.34)	(3.31)	(0.63)	(-1.33)
MKT	-0.112**	0.254***	0.227***	0.239***	0.298***
	(-2.28)	(4.27)	(3.35)	(4.29)	(4.19)
SMB		0.068**	0.07**	0.21***	0.056**
		(2.33)	(2.35)	(6.47)	(2.05)
HML		-0.263***	-0.275***	-0.441***	
		(-9.56)	(-8.64)	(-15.16)	
MOM			0.039		
			(1.08)		
RMW				0.288***	
				(8.03)	
CMA				-0.057***	
				(-2.92)	
IA					-0.127***
					(-5.03)
ROE					0.131***
					(4.77)
$adj\ R^2$	0.018	0.136	0.136	0.235	0.112

Panel B. ESGC

	(1)	(2)	(3)	(4)	(5)
α	0.623***	0.76***	0.74***	0.711***	0.609***
	(12.63)	(14.39)	(11.36)	(13.08)	(9.45)
ESGC	-0.181***	-0.156***	-0.159***	-0.097***	-0.196***
	(-7.37)	(-6.11)	(-6.2)	(-3.95)	(-7.98)
MKT	0.376***	0.215***	0.237***	0.203***	0.385***
	(7.14)	(3.83)	(3.43)	(3.7)	(5.77)
SMB		0.032	0.031	0.199***	0.136***
		(1.05)	(1.02)	(6.2)	(4.12)
HML		-0.186***	-0.175***	-0.369***	
		(-6.88)	(-5.31)	(-12.39)	
MOM			0.068*		
			(1.91)		
RMW				0.283***	
				(7.97)	
CMA				-0.072***	
				(-3.81)	
IA					-0.097***
					(-5.21)
ROE					0.135***
					(5.24)
$adj\ R^2$	0.063	0.155	0.155	0.258	0.189

Note. This table represents the results of Fama-MacBeth regression for *ESG* and *ESGC* with the Newey-West estimator (max-lag 6). Panel A shows the regression results of *ESG*, which is calculated by

subtracting the return of the 1st tercile from that of the 3rd tercile, after sorting by Refinitiv ESG score. Panel B shows the regression results of *ESGC*, which is calculated by subtracting the return of non-100 pts from that of 100 pts based on Refinitiv ESG controversies score, as the dependent variables. For each Panel, models (1), (2), (3), (4), and (5) correspond to CAPM, FF3, C4, FF5, and q-factor as the control factor model. $adj\,R^2$ refers to adjusted R-squared. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

Figure 1. Cumulative return of ESG-related factors (ESG, ESGC)

Note. The figure shows the cumulative return of ESG-related factors (*ESG*, *ESGC*) during the period from Jul 2003 to Dec 2021. The dashed line indicates *ESG* and the solid line indicates *ESGC*.