ESG, firm image, and explanatory power for expected returns

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Highlight

• Long-short portfolios sorted on advertisement-adjusted ESG scores exhibit significant alpha values.
• The controlled ESG factor has explanatory power for stock returns.

Abstract

This letter examines whether ESG controlled by firms' interest in their image explains the cross-section of expected returns. We use the LASSO (Least Absolute Shrinkage and Selection Operator) method to select a handful of useful factors that explain the stock market from tons of factors. The controlled ESG factor has significant alpha and explanatory power for expected returns after controlling both the selected factors and other well-known factors.

Keywords: ESG; Factor zoo; Firm image; Machine learning
JEL Classification:

1.Introduction

The relationship between ESG (Environmental, Social, and Governance) and the cross-section of stock market returns has received considerable attention recently (Bang, Ryu, and Yu, 2023; Gillan, Koch, and Starks, 2021). According to Hartzmark and Sussman (2019), mutual funds make investment decisions considering ESG integration and practitioners share the belief that funds that value ESG will outperform and have lower risk exposures. At this point, analyzing the relationship between ESG and expected returns is important for understanding the impact of sustainability on the market.

While prior literature has focused on whether ESG can be a priced factor (Bang, Ryu, and Webb, 2023; Bang and Ryu, 2023; Cornell, 2021; Pedersen, Fitzgibbons, and Pomorski, 2021), we contribute by analyzing whether ESG, which is controlled by firms' interest in their image, has explanatory power for expected returns. Some studies argue that corporate social responsibility, which is related to ESG, is associated with firms' image or reputation (Fombrun and Shanley, 1990; Gao, Lisic, and Zhang, 2014). If investors recognize that firms exploit ESG as a tool for enhancing their positive image, such as advertising, they can determine that ESG-related risk is reduced when ESG activities go beyond the efforts to build firms' positive image. A firm's positive image can act as a moral benchmark and investors can insist on ESG performance that surpasses the benchmark. Since advertising spending is a representative method to enhance brand value (Barth, Clement, Foster, and Kasznik, 1998), this study examines whether ESG divided by advertising intensity, which is an indicator of firms' interest in their positive image, can have explanatory power for expected returns.

Tons of papers in financial economics have already addressed and proposed risk factors. Thus, it is crucial to thoroughly explore the explanatory power of our controlled ESG factors by exploiting the factor zoo. If these are not sufficiently considered, it may be overlooked that the ESG factor does not have a significant premium or can be explained by other factors. As such, we use the double-selection LASSO (Least Absolute Shrinkage and Selection Operator) method, proposed by Feng, Giglio, and Xiu (2020) to test whether the new risk factor provides additional explanatory power despite a variety of risk factors using the LASSO algorithm, the machine learning technique. We identify factors explaining well the cross-section of expected return and use them as a control variable. Including an excessive number of variables in the model can lead to invalid inferences. Therefore, a variable selection process is sometimes required to choose an appropriate dimension. In this sense, LASSO provides a relatively simple and powerful tool. In our result, these selected factors are not included in the Fama and French factor models or Hou, Xue, and Zhang's (2015) *q*-factor. Therefore, it allows us to test robustly our ESG factor.

In the analysis of the decile portfolio based on the ESG score divided by advertising intensity, the expected returns on portfolios decrease as the controlled ESG score increases. Furthermore, our findings show that the controlled ESG factor is mispricing by the well-known factors and the selected factors. Our controlled ESG factor has explanatory power for expected returns by estimating the prices of covariance risk under the various control factors. It implies that, given two firms with similar ESG activities, one firm that is less interested in building a positive image has lower expected returns than the other firm that is more interested. It supports that ESG influences investors' decisions through firm image channels.

2.Data and factor construction

We analyze the U.S. stock market such as NYSE, AMEX, and NASDAQ from 2002 to 2020. We use the ESG score from Refinitiv's Datastream and advertising expenditure (item: XAD) and total assets (item: AT) from the Compustat database. The ESG score ranges from 0 to 100, with higher scores indicating better ESG performance. We exclude companies with advertising expenditure or total assets below 0 and include delisted companies. We measure "advertising intensity" as advertising expenditure divided by total assets. The total firm-year observation is 11,926. The mean, standard deviation, minimum, median, and maximum are 265.46, 1153.64, 0.06, 48.27, and 80,864.96, respectively. The number of firms has increased from 173 in 2002 to 1,423 in 2020.

We calculate two types of monthly value-weighted portfolios. First, we form one-way decile portfolios sorted on ESG score divided by advertising intensity to examine long-short portfolio alphas. Second, we form 3 by 2 portfolios sorted on ESG score scaled by advertising intensity and size to form the controlled ESG risk factor (*CESG*). To form it, the firms are divided into tercile (low, medium, and high) by the scaled ESG, and firms are divided into big and small by the median of market cap. The value of *CESG* is the difference between the average returns of high-big and high-small portfolios and the average returns of low-big and low-small portfolios. We also use the scaled ESG data to calculate returns on portfolios from July of year t+1 to June of year t+2 to avoid look-ahead bias. For the period from July 2003 to December 2021, we consider various test portfolios based on market anomalies (Hou, Xue, and Zhang, 2020).[1]

3.Methodology

First, we select control factors using a part of the double-selection LASSO proposed by Feng, Giglio, and Xiu (2020):

$$\overline{ER_i} = \alpha + \sum_{k=1}^{K} \beta_k Cov(f_k, ER_i) + \epsilon_i \text{ , s.t. } \sum_{k=1}^{K} |\beta_k| \leq t, \tag{1}$$

where $\overline{ER_i}$ is the average return of a test portfolio i over time. α and ϵ_i are the constant, that is the unexplained part by the given risk factors, and the error term, respectively. $Cov(f_k, ER_i)$ is the covariance between a factor f_k and a test portfolio return ER_i. β_k is the coefficient of the covariance. LASSO regularizes and selects the risk factors through some restrictions on the betas under the given tuning parameter. As such, we set a sequence of 40 real numbers that increase in 0.1 units from -11 to -7.1 and take it as the exponents of 10. The sequence is used for the tuning parameters. After running LASSO regression for each of the 40 tuning parameters, we calculate a selection rate as how many times the given factor is selected over the 40 regressions and choose ten factors with the highest selection rate. Specifically, we use 161 factors as controls, consisting of three factors (size, investment, profitability) from Hou, Xue, and Zhang's database, five factors (market, size, value, investment, and profitability) from Kenneth French's database[3], and 153 factors from Jensen, Kelly, and Pedersen's (2023) database[4]. We select 77 factors taking into account the excessive correlation between factors among 161 factors to avoid multicollinearity. In detail, we include only one representative factor among

[1] https://global-q.org/testingportfolios.html
[3] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[4] https://jkpfactors.com

two factors whose absolute value of the correlation coefficient is greater than 0.8. For the selected factors, the average of portfolio returns regress on covariance between test portfolio returns and factor returns. The covariance matrix is 1853 by 77, equal to the number of test portfolios and the number of factors, respectively. According to the procedure, we pin down ten factors that have high explanatory power for expected returns over our analysis period: *QMJ* (quality minus junk), *TA* (tangibility), *RD* (R&D expenditure scaled by market equity), *NDI* (net debt issuance scaled by assets), *CEI* (the number of consecutive earnings increases), *EV* (earnings variability), *REV* (short term reversal), *ENI* (equity net issuance scaled by assets), and *PF* (Piotroski's F-Score).

Next, we test whether the alphas of the controlled ESG long-short portfolios are significant to verify that the established factors cannot explain them using the following specification.

$$CESG_t = \alpha + F_t \Lambda + \epsilon_t \quad (2)$$

We use several control factor sets F_t: the Capital Asset Pricing Model (CAPM) consisting of the excess market returns (*MKT*); the Fama-French 3-factor model (FF3) consisting of *MKT*, the size factor (*SMB*), and the book-to-market factor (*HML*); Carhart 4-factor model (C4) consisting of Fama-French three factors and the momentum (*MOM*); Fama-French 5-factor model (FF5) consists of *MKT*, *SMB*, *HML*, the profitability factor (*RMW*), and the investment factor (*CMA*); q-factor model consisting of *MKT*, *SMB*, the return-on-equity factor (*ROE*), and the investment-to-asset factor (*IA*). We also estimate the αs in equation (1) using the selected ten factors and their subsets as F_t. The first subset consists of the four factors with the highest selection rate, and sequentially one or two factors with the next highest selection rate are added to the subset to form the other subsets.

Third, we examine whether the controlled ESG factor has explanatory power using the following specification.

$$\overline{ER_i} = \beta_0 + \beta_1 C_{CESG} + \mathbb{C}\mathrm{B} + \epsilon_i, \quad (3)$$

where $\overline{ER_i}$ is the average returns of test portfolio i over time. C_{CESG} ($\mathbb{C}$) is the covariance between *CESG* (the control factors) and the portfolio returns. We use the same control factors as equation (1), such as CAPM, FF3, C4, FF5, q-factor, the ten selected factors, and their subsets.

4.Results

Table 1 shows the analysis of one-way decile portfolios. *Low* (*High*) indicates the portfolio composed of firms with the lowest (highest) controlled ESG scores. *P2* to *P9* refer to the second to the ninth decile portfolios between *Low* and *High*. *H-L* means the returns of *High* minus those of *Low*. *Mean* is the average value of monthly portfolio returns. α_{CAPM}, α_{FF3}, α_{C4}, α_{FF5}, α_q, and α_{SEL}

indicate the constants from regression of each decile portfolio on CAPM, FF3, C4, FF5, q-factor, and the ten selected factors, respectively. The first row shows the means and the Newey-West t-statistics for the excess returns on the portfolios. It shows that the mean decreases from the lowest decile to the highest decile. In addition, *Mean* of *H-L* is -0.831 (t-statistic = -1.86), which is significant at the 10% level. Even when controlled by several factor models, the alphas generally decrease from *Low* to *High*, and the alphas of *H-L* is significant at the 1% level in all factor models. This implies that controlled ESG can be a factor that cannot be explained by existing factors.

Table 1
Decile portfolios analysis

	Low	P2	P3	P4	P5	P6	P7	P8	P9	High	H-L
Mean	0.706*	0.559	0.732***	0.586*	0.344	0.620**	0.771***	0.381	0.399	-0.031	-0.831*
	(1.85)	(1.64)	(2.62)	(1.78)	(1.33)	(2.27)	(2.71)	(1.17)	(0.83)	(-0.06)	(-1.86)
α_{CAPM}	-0.118	-0.346*	-0.051	-0.263	-0.387***	-0.119	-0.024	-0.55***	-0.704***	-1.188***	-1.167***
	(-0.44)	(-1.81)	(-0.32)	(-1.46)	(-2.93)	(-0.96)	(-0.15)	(-3.90)	(-3.06)	(-4.69)	(-2.84)
α_{FF3}	-0.196	-0.389**	-0.145	-0.287	-0.430***	-0.141	-0.076	-0.552***	-0.677***	-0.995***	-0.896***
	(-0.79)	(-2.16)	(-1.02)	(-1.58)	(-3.16)	(-1.13)	(-0.51)	(-3.95)	(-2.85)	(-5.53)	(-3.10)
α_{C4}	-0.184	-0.371**	-0.153	-0.273	-0.445***	-0.140	-0.065	-0.544***	-0.650***	-0.931***	-0.844***
	(-0.74)	(-2.13)	(-1.07)	(-1.49)	(-3.10)	(-1.13)	(-0.44)	(-3.90)	(-2.85)	(-5.09)	(-2.86)
α_{FF5}	-0.096	-0.414**	-0.085	-0.290	-0.512***	-0.222*	-0.097	-0.539***	-0.559**	-0.756***	-0.760***
	(-0.39)	(-2.19)	(-0.59)	(-1.60)	(-3.53)	(-1.88)	(-0.63)	(-3.82)	(-2.39)	(-4.82)	(-2.64)
α_q	0.047	-0.276	-0.131	-0.245	-0.492***	-0.143	-0.061	-0.586***	-0.597**	-0.966***	-1.110***
	(0.21)	(-1.43)	(-0.87)	(-1.26)	(-3.44)	(-1.22)	(-0.38)	(-4.15)	(-2.47)	(-3.58)	(-2.94)
α_{SEL}	-0.023	-0.311*	-0.037	-0.395**	-0.476***	-0.252**	-0.219	-0.657***	-0.636***	-0.972***	-1.052***
	(-0.11)	(-1.88)	(-0.25)	(-2.40)	(-3.31)	(-2.09)	(-1.35)	(-4.78)	(-2.59)	(-3.97)	(-3.51)

Note. Newey-West t-statistics (lag 6) represent in parentheses. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

Next, we examine whether there are high correlations among the factors. Table 2 shows the correlation matrix of the factors in our study. Overall, there are no worryingly highly correlated factor pairs. In particular, the correlation between *CESG* and other factors is a maximum of 0.51 (with *HML*) and a minimum of -0.35 (with *QMJ*). Thus, it is free of multicollinearity issues resulting from the high correlation between *CESG*.

Table 2
Factor correlation matrix

	MKT	SMB	HML	MOM	RMW	CMA	IA	ROE	QMJ	TA	RD	NDI	CEI	EV	REV	ENI	PF
SMB	0.41																
HML	0.24	0.34															
MOM	-0.32	-0.21	-0.44														
RMW	-0.23	-0.39	-0.03	0.00													
CMA	-0.07	0.12	0.47	-0.11	-0.02												
IA	-0.05	0.17	0.51	-0.19	-0.04	0.90											
ROE	-0.45	-0.53	-0.27	0.52	0.53	-0.03	-0.11										
QMJ	-0.53	-0.55	-0.62	0.52	0.43	-0.30	-0.34	0.73									
TA	0.34	0.51	-0.03	0.05	-0.31	-0.10	-0.08	-0.36	-0.26								
RD	0.36	0.36	-0.03	-0.21	-0.55	-0.06	-0.01	-0.47	-0.35	0.27							
NDI	0.28	0.13	0.45	-0.25	0.21	0.26	0.29	-0.04	-0.31	-0.07	-0.11						

CEI	-0.38	-0.37	-0.46	0.39	0.27	-0.22	-0.28	0.70	0.74	-0.21	-0.22	-0.20					
EV	-0.48	-0.36	0.09	0.03	0.39	0.00	0.02	0.37	0.27	-0.60	-0.38	-0.11	0.22				
REV	0.42	0.23	0.20	-0.20	-0.22	-0.03	-0.01	-0.21	-0.37	0.12	0.22	0.22	-0.17	-0.28			
ENI	-0.24	-0.40	0.27	-0.25	0.64	0.28	0.30	0.40	0.22	-0.67	-0.33	0.27	0.18	0.54	-0.12		
PF	-0.42	-0.50	-0.18	0.30	0.45	-0.01	-0.06	0.79	0.61	-0.40	-0.41	0.06	0.74	0.36	-0.19	0.41	
CESG	0.18	0.21	0.51	-0.29	-0.15	0.18	0.24	-0.19	-0.35	0.06	0.24	0.29	-0.23	-0.04	0.17	0.09	-0.08

Note. The table shows the correlation coefficients among the well-known factors, the ten selected factors, and *CESG*.

According to equation (2), we examine whether the controlled ESG factor has a significant alpha even when controlling for the factor models. Table 3 reports the estimation of pricing anomalies for *CESG* using the well-known factors (selected factors) in Panel A (Panel B). The used control factors are CAPM, FF3, C4, FF5, and *q*-factor for Models (1)-(5) in Panel A. The αs of *CESG* are significantly negative at the 1% level in Models (1)-(10). This result suggests that the well-known factors and the selected factors are insufficient to account for *CESG*. Furthermore, *F*-statistics (*F-stat.*) are significant at least the 5% level in Models (1)-(10). The adjusted-R^2 (*Adj.-R^2*) with the FF5 is the largest in Table 3. It means the FF5 is the most appropriate to explain *CESG*. The significance of the coefficients of *HML* and *IA* implies that the value and investment factor partially explain the controlled ESG portfolio.

Table 3
Tests of pricing anomalies

Panel A. Well-known factors as controls

	(1)	(2)	(3)	(4)	(5)
α	-0.744***	-0.618***	-0.606***	-0.521***	-0.706***
	(-3.52)	(-3.39)	(-3.36)	(-3.06)	(-3.81)
MKT	0.127**	0.040	0.028	0.021	0.091
	(2.48)	(0.64)	(0.44)	(0.35)	(1.55)
SMB		0.026	0.027	-0.032	0.101
		(0.34)	(0.37)	(-0.44)	(1.17)
HML		0.491***	0.463***	0.543***	
		(5.46)	(5.68)	(5.04)	
MOM			-0.054		
			(-0.92)		
RMW				-0.211	
				(-1.49)	
CMA				-0.125	
				(-0.77)	
IA					0.366***
					(2.65)
ROE					-0.066
					(-0.59)
F-stat.	6.13**	11.50***	9.60***	8.16***	7.17***
Adj.-R^2	0.030	0.255	0.256	0.266	0.090

Panel B. Selected factors as controls

	(6)	(7)	(8)	(9)	(10)
α	-0.594***	-0.591***	-0.633***	-0.725***	-0.747***
	(-3.01)	(-3.20)	(-3.56)	(-4.06)	(-4.29)

MKT	-0.013	-0.062	-0.029	-0.043	-0.028
	(-0.22)	(-1.10)	(-0.46)	(-0.67)	(-0.50)
QMJ	-0.368***	-0.275***	-0.253*	-0.269	-0.284*
	(-3.68)	(-3.21)	(-1.67)	(-1.64)	(-1.69)
TA	-0.091	-0.023	0.118	0.268	0.309*
	(-0.47)	(-0.16)	(0.73)	(1.61)	(1.95)
RD	0.187**	0.276***	0.324***	0.331***	0.375***
	(2.21)	(3.48)	(4.24)	(4.29)	(4.62)
NDI		0.670***	0.730***	0.569**	0.453*
		(2.87)	(2.90)	(2.49)	(1.86)
CEI			0.009	-0.007	-0.349
			(0.03)	(-0.03)	(-1.24)
EV			0.349*	0.254	0.241
			(1.73)	(1.28)	(1.17)
REV				0.045	0.046
				(0.73)	(0.79)
ENI				0.308**	0.278*
				(2.09)	(1.90)
PF					0.343*
					(1.88)
F-stat.	8.50***	9.44***	6.46***	5.49***	5.69***
Adj.-R^2	0.125	0.177	0.187	0.200	0.216

Note. Newey-West *t*-statistics (lag 6) represent in parentheses. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

Finally, we estimate prices of covariance risk as in equation (3) to test whether the controlled ESG factor has additional explanatory power for expected returns. Table 4 shows prices of covariance risk for *CESG*. The control factors are CAPM, FF3, C4, FF5, and *q*-factor (the ten selected factors and the subsets) in Panel A (Panel B). The prices of covariance risk of *CESG* are significant and negative at the 5% level in all Models except (4) and (6). The adjusted-R^2 of Model (10), which includes all the selected factors, is 0.389, which is much higher than that of the FF5. Also, even, the adjusted-R^2 of model (6) consisting of the four selected factors and *CESG* is higher than that of the FF5. It means that the selected factor has a higher explanatory power than the existing known factor. 8 out of 10 Models in Table 4 show that the controlled ESG factor has explanatory power for expected returns. The negative coefficient means that the higher the controlled ESG, the lower the expected return. It means that there is an expectation that firms that value their image will engage in more ESG activities and that ESG participation beyond this expectation will lead to lower expected returns.

Table 4

Estimation of prices of covariance risk

Panel A. Well-known factors as controls					
	(1)	(2)	(3)	(4)	(5)
constant	0.791***	0.806***	0.835***	0.684***	0.600***
	(22.21)	(14.98)	(12.85)	(12.75)	(8.92)
CESG	-0.059***	-0.031***	-0.030***	-0.008	-0.051***
	(-12.23)	(-2.63)	(-2.62)	(-0.70)	(-6.85)

MKT	0.016***	0.014***	0.011*	0.023***	0.034***
	(7.31)	(3.02)	(1.94)	(4.68)	(5.39)
SMB		0.005	0.007	0.085***	0.021**
		(0.63)	(0.86)	(8.84)	(2.54)
HML		-0.020**	-0.023**	-0.095***	
		(-2.54)	(-2.55)	(-9.59)	
MOM			-0.003		
			(-0.82)		
RMW				0.143***	
				(9.81)	
CMA				0.055***	
				(4.32)	
IA					0.004
					(0.38)
ROE					0.048***
					(5.59)
F-stat.	77.37***	38.16***	30.29***	50.47***	39.12***
Adj.-R^2	0.114	0.121	0.121	0.230	0.147

Panel B. Selected factors as controls

	(6)	(7)	(8)	(9)	(10)
constant	0.739***	0.748***	0.656***	0.695***	0.736***
	(12.07)	(12.56)	(11.59)	(12.44)	(12.47)
CESG	-0.000	-0.027**	-0.032***	-0.051***	-0.046***
	(-0.04)	(-2.17)	(-2.69)	(-5.11)	(-4.39)
MKT	0.020***	0.011*	0.039***	0.029***	0.025***
	(3.25)	(1.81)	(6.06)	(4.31)	(3.59)
QMJ	0.056***	0.062***	0.111***	0.058***	0.059***
	(6.65)	(7.47)	(9.12)	(4.66)	(4.76)
TA	0.011	0.016*	0.122***	0.193***	0.185***
	(1.18)	(1.87)	(9.89)	(13.83)	(12.97)
RD	0.046***	0.069***	0.112***	0.100***	0.092***
	(5.37)	(6.53)	(11.39)	(10.57)	(9.48)
NDI		0.088***	0.140***	0.007	0.027
		(2.93)	(5.17)	(0.27)	(0.98)
CEI			-0.055***	0.006	0.061*
			(-2.71)	(0.27)	(1.82)
EV			0.229***	0.058***	0.055***
			(11.19)	(2.67)	(2.58)
REV				-0.031***	-0.031***
				(-3.12)	(-3.13)
ENI				0.181***	0.183***
				(13.59)	(14.12)
PF					-0.041**
					(-2.21)
F-stat.	46.83***	45.46***	54.51***	73.53***	71.25***
Adj.-R^2	0.191	0.199	0.280	0.386	0.389

Note. Newey-West *t*-statistics (lag 6) represent in parentheses. *, **, and *** indicate the significance at level 10%, 5%, and 1%, respectively.

4.Conclusion

We examine the explanatory power of ESG controlled by firms' interest in their image for the cross-section of stock market returns. By utilizing the LASSO regression, we choose the ten factors explaining the cross-section of expected returns from numerous factors. The portfolios based on the controlled ESG and the controlled ESG factor have significant alphas. The controlled ESG factor has significantly negative prices of covariance risk when using the well-known factors and the selected factors as controls, indicating that it explains the cross-section of expected returns. It implies that ESG through the firm image channel affects the actual stock market.

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