The Relationship Between ESG Rating and the Cost of Equity Capital: Evidence from China

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Abstract. With increasing market attention to corporate Environment, Social and Governance (ESG) practice, ESG Score plays an important part in a firm's stock performance. Through regression analysis, this study aims to find out the relationship between ESG score and a firm's cost of equity capital. The sample comprises 4365 effective samples covering 1035 Shanghai-Shenzhen A-share enterprises for the period spanning 2015 through 2020. The results show that there is a significant negative correlation between the ESG score and the firm's cost of equity capital. The analysis also shows that the G score in ESG score has the most significant impact on the company's cost of equity capital. For the robustness test, this study replaced the explained variables, lagged the explained variables by one stage and focused on the endogeneity study. The study found that the likelihood of a positive effect on ESG scores was small. The findings of this study provide evidence for previous literature and provide guidance for corporate governance.

Keywords: Environment Social and Governance; The cost of equity capital.

1. Introduction

Environmental, social, and governance (ESG) practices have become increasingly concern for investors, especially after Covid-19. China plays an important role in global sustainable development. The Chinese government has passed a series of laws and regulations requiring Chinese enterprises to undertake environmental protection, social responsibility, and corporate governance responsibilities. Due to the short-time popularity of ESG in China, the specific impact of ESG on Chinese companies is worth further exploration. Worldwide, there is a lot of research looking at ESG spending and company performance. Some argue that spending on ESG is unnecessary because it takes away resources that could be spent on core technology R&D without bringing in monetary revenue, and instead hinders business growth. Similarly, some scholars have found that ESG scores are considerably negatively connected with financial performance in several developing nations with relatively low productivity, such as Brazil and Malaysia. In China, a uniquely fast developing country, companies prefer to raise capital from external debt markets rather than external equity markets. Therefore, the current study has not reached a unified conclusion about this unique market in China. In addition, existing research has focused on the impact of ESG practices as a whole on firms' cost of equity capital. There is limited research on the E-score, S-score, and G-score alone and the company's cost of equity capital. Therefore, my research motivation was to fill a gap in the previous literature and provide my account of how ESG scores both collectively and individually affect the cost of equity capital of Chinese companies. This paper studies the impact of ESG score on the cost of equity capital of Chinese listed companies. To test this hypothesis, this study uses multiple linear regression method and adds 8 control variables and industry fix effects and year fix effects. the results show that ESG score significantly reduces the cost of equity capital. In order to further determine the impact of ESG score on the cost of equity capital, this study studies state-owned enterprises and non-state-owned enterprises separately and manufacturing companies and non-manufacturing companies separately. The results show that the higher the ESG score of both state-owned and non-state-owned enterprises and manufacturing and non-manufacturing companies, the lower the cost of equity capital. In addition, in order to verify hypothesis 2, the impact of E (Environment) score, S (Social) score and G (Government) score on the company's cost of equity should be tested respectively. the results show that among the three, the G (government) score has the most significant impact on the cost of equity of a company. This also supports my hypothesis. Finally, I conducted a robustness test to ensure the

stability of the research results. The research shows that there is an obvious negative correlation between ESG score and the cost of equity capital. My research contributes to the literature in two ways. First of all, this study fills the gap of the impact of ESG score on equity capital financing cost of Chinese listed companies. Most studies do not cover the Chinese market, so it is necessary to conduct separate studies on Chinese listed companies. In addition, to the best of our knowledge, this study is the first to independently examine the environmental, social, and government scores in ESG scores on the cost of equity capital of Chinese companies. It can be seen from the research that in ESG score, G (government) score has a positive impact on the cost of equity of a company, while E (Environment) score and S (Social) score have a negative impact on the cost of equity of the listed company. This has important guiding significance for the future governance of Chinese companies1[1].

2. Literature Review

There have two kinds of cost of capital, one is the cost of equity and the other is the cost of debt. Existing studies have proven that ESG performance is positively correlated with both measures of cost of capital (i.e., cost of equity and cost of debt). Therefore, it is important to understand the relationship between ESG and the cost of equity capital.

Many studies have looked at the relationship between ESG scores and the cost of equity capital in developed countries. By examining the association between environmental, social and governance (ESG) performance and the cost of capital of large European companies listed on STOXX Euro 600 between 2002 and 2018,believe that there is a correlation between better ESG performance and lower cost of equity. Similarly, by analyzing a sample of 2,599 observations relating to listed European companies, proposes negative ESG performance will increase the cost of equity capital, but it is doubtful whether positive ESG performance can reduce the cost of equity capital. also discover that among ESG scores, negative environmental impact (E) has the most serious impact on an enterprise's cost of equity capital.

There also have some evidence from other countries. ran a linear regression on a sample of 154 French ESG companies from 2015 to 2020 and found that CSR activities reduced the cost of equity capital. Besides, using a sample of 30 companies listed on the UAE financial market, Ould Daoud Ellili (2020) concludes that ESG disclosure has a significant negative impact on the cost of equity. For firms in America, Elmawazini et al. (2022) put forward that greater green technology innovation is associated with a lower cost of equity capital. Overall, there is a rarely researched area on whether ESG scores could negatively impact a firm’s cost of equity capital in China and how E, S, and G scores respectively impact a firm’s cost of equity capital.

Based on my preliminary research and previous studies, I develop the following hypothesis:

H1: The higher the ESG rating, the lower the cost of equity capital[2].

H2: Among E scoring, S scoring, and G scoring, G scoring has the greatest impact on the cost of equity capital.

3. Research Methodology

3.1 Data Collection and Sample

Two databases are used in this study, the Bloomberg database, and the China Stock Market & Accounting Research Database (CSMAR) database. From the Bloomberg database, I obtained ESG Grading information on CSI 300 constituents from 2011 to 2020, which exported items including Rate Year, Stock Code, Company Full Name, Industry name, industry code, ESG score, E score, S score, and G score. A total of 10821 pieces of data are obtained in my research. To narrow the order of magnitude difference, the ESG score, E score, S score, and G score are all calculated by dividing the original number by 100 in this paper. Since most companies had missing ESG scores from 2011 to 2014, ESG score data from 2015 to 2020 were selected for the study. For ESG score data from

2015 to 2020, st (investment risk), st* (delisting risk), and incomplete samples were deleted in this study. Then, after 1% and 99% tail reduction of samples to exclude the influence of extreme values, 4,365 effective samples of 1,035 Shanghai-Shenzhen A-share enterprises from 2015 to 2020 were finally collected. The cost of equity capital refers to the cost that a company pays to obtain funds by issuing shares, it is also the opportunity cost of existing shareholders to invest capital, and it is also the minimum rate of return required by common shareholders. The cost of equity capital is the dependent variable for this study. This study used the Capital Asset Pricing Model (CAPM) (Sharp, 1964) to explain variables. The independent variable of this study was the ESG score. Company size, sales growth rate, asset-liability ratio, turnover ratio, company nature, asset-liability ratio, return on assets, and years of establishment are control variables. Information, about company size, sales growth rate, asset-liability ratio, turnover ratio, company nature, asset-liability ratio, return on assets, and years of establishment, are obtained from CSMAR[3].

3.2 Measurement & Date analysis

The basic idea of this study comes from Di Tommaso and Thornton (2020), who bring the idea of the bidirectional fixed effects model. Learning from Di Tommaso and Thornton (2020), the following bidirectional fixed effects model is established.

$$COE_{i,t} = \varphi_0 + \mu_i + \varphi_1 ESG_{i,t} + \varphi C + \Sigma INDUSTRY_i + \Sigma YEAR + \varepsilon_{i,t} \quad (1)$$

In this model, φ_0 is the intercept term, μ_i is the unobserved individual-specific effect, $COE_{i,t}$ is the dependent variable, $ESG_{i,t}$ is the independent variable, φ_1 is the coefficient vector of the independent variable, φ is the control variable coefficient vector, C is the control variable matrix, $\Sigma INDUSTRY_i$ is the industry effect, $\Sigma YEAR_t$ is the time effect, and $\varepsilon_{i,t}$ is the random disturbance term. Among these estimators, φ_1 is the key coefficient because it implies that ESG performance will significantly push up the cost of the equity capital of the enterprise and reduce its value if it is significantly positive; otherwise, it means the opposite if it is significantly negative.

For the cost of equity capital, how to measure the cost of equity capital of a company is still debatable. Based on previous research results, there are several models to measure the cost of equity capital by the realized rate of return, such as the Capital Asset Pricing Model (Sharpe, 1964) and Fama-French 3-Factor Model (Fama & French, 1993). In this study, I utilize Capital Asset Pricing Model (CAPM) to calculate the cost of equity capital. The following is the equation[4].

$$R_e = R_f + \beta\left(R_m - R_f\right) \quad (2)$$

In this model, R_f is the risk-free rate, which is replaced by the weighted average interest rate on one-year time deposits, weighted by days. β comes from the CSMAR database. In the process of estimating the cost of capital by year, R_m was less than 0 in many years, which led to a large number of negative values in the final calculated cost of capital. Therefore, the practice of using the actual risk premium as the expected risk premium was finally abandoned. $R_m - R_f$ uses Damodaran's estimates of China's market risk premium for 2020-2021. In the following study, the cost of equity calculated by the CAPM model is represented as the COE.

In this study, eight control variables are selected, which are Growth, Size, LEV, M2B, Turn, SOE, and ROA. In this study, I controlled for the time effect to avoid the possible false regression caused by the time trend, and I also controlled for the industry effect, considering that different industries may face different risks. Therefore, here comes my own regression model.

$$\begin{aligned} COE_{i,t} = {} & \beta_0 + \beta_1 ESG_{i,t} + \beta_2 GROWTH_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LEV_{i,t} + \beta_5 M2B_{i,t} + \beta_6 TURN_{i,t} \\ & + \beta_7 SOE_{i,t} + \beta_8 ROA_{i,t} + \beta_9 FIRMAGE_{i,t} + Industry\ Fixed\ Effect + Year\ Fixed\ Effect + \varepsilon_{i,t} \end{aligned} \quad (3)$$

To test hypothesis 2, I substitute the individual scores of E, S, and G for the total ESG score into the regression equation to obtain Equation 4.

$$COE_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 S_{i,t} + \beta_3 G_{i,t} + \beta_4 GROWTH_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 LEV_{i,t} + \beta_7 M2B_{i,t} + \beta_8 TURN_{i,t} + \beta_9 SOE_{i,t} + \beta_{10} ROA_{i,t} + \beta_{11} FIRMAGE_{i,t} + Industry\ Fixed\ Effect + Year\ Fixed\ Effect + \varepsilon_{i,t} \quad (4)$$

For hypothesis 2, an important problem is to explore the specific contribution degree of different explanatory variables to the variance of the explained variables. A common method in the literature is stepwise regression, which is the gradual introduction of explanatory variables into regression and significance test. However, the order in which explanatory variables are introduced in stepwise regression is highly subjective. Moreover, significance tests also do not always rank different explanatory variables in order of importance. Based on this, Isareli (2006) proposes the method of Dominance Analysis on the basis of previous studies. The aim of this method is to determine the contribution of different explanatory variables to the determination coefficient (R2) in linear regression. In fact, the degree of contribution to the determination coefficient (R2) also reflects the degree of contribution of different explanatory variables to the variance of the explained variable. In this study, the contribution of the explanatory variable should be equivalent to the marginal effect of R2.

Table 1 shows that after dividing by 100, the highest ESG score is 0.6411, the lowest ESG score is 0.0579, the average ESG score is 0.2149 and the standard deviation is 0.0733. This shows that there are listed companies' ESG performance differences [5].

Table 1. Descriptive statistics

VarName	Obs	Mean	SD	Min	Median	Max
COE	4365	0.0827	0.0192	0.0151	0.0829	0.1685
ESG scores	4365	0.2334	0.0733	0.0579	0.2149	0.6411
E score	4365	0.1223	0.0907	0.0078	0.1008	0.6563
S score	4365	0.2628	0.1016	0.0351	0.2281	0.7719
G score	4365	0.4617	0.055	0.0357	0.4821	0.7321
Size	4365	23.7138	1.5999	20.3719	23.4748	31.1379
Growth	4365	0.2481	2.1111	-0.9183	0.1046	84.992
Lev	4365	0.4914	0.2001	0.0197	0.4967	0.9752
M2B	4365	2.3985	13.4969	0.0331	0.9482	466.9396
Turn	4365	0.6419	0.4847	0.0000	0.5522	7.305
SOE	4365	0.5010	0.5001	0.0000	1.0000	1.0000
ROA	4365	0.0545	0.0555	-0.3933	0.0415	0.6689
FirmAge	4365	2.9927	0.2881	1.7918	3.0445	3.7377

Table 2. Pearson correlation coefficients between regression variables

	COE	*ESG Score*	*E score*	*S score*	*G score*	*Size*	*Growth*	*Lev*	*M2B*	*Turn*	*SOE*	*ROA*	*FirmAge*
COE	1												
ESG score	-0.156***	1											
E score	-0.162***	0.928***	1										
S score	-0.155***	0.799***	0.596***	1									
G score	0.026*	0.576***	0.397***	0.374***	1								
Size	-0.184***	0.501***	0.410***	0.368***	0.521***	1							
Growth	0.017	-0.024	-0.021	-0.023	-0.013	-0.001	1						
Lev	0.027*	0.231***	0.171***	0.152***	0.314***	0.639***	0.021	1					
M2B	-0.081***	0.141***	0.115***	0.093***	0.158***	0.322***	-0.005	0.207***	1				
Turn	-0.015	-0.002	0.030**	-0.002	-0.061***	-0.169***	0.036**	-0.059***	-0.094***	1			
SOE	0.048***	0.205***	0.151***	0.156***	0.287***	0.321***	-0.018	0.234***	0.086***	-0.028*	1		
ROA	-0.118***	-0.092***	-0.055***	-0.070***	-0.151***	-0.251***	0.051***	-0.474***	-0.095***	0.215***	-0.215***	1	
FirmAge	-0.164***	0.123***	0.082***	0.062***	0.190***	0.159***	-0.020	0.139***	0.015	-0.047***	0.142***	-0.027*	1

4. Findings

4.1 Main Result

This study mainly examines the relationship between the cost of equity capital and ESG score performance. My dependent variable is the cost of equity capital, which is measured by the Capital asset pricing model. Table 2 presents the main results of the baseline regression model between the cost of equity capital and ESG score performance. Based on previous literature, my regressions control for firm size, annual revenue growth, asset-liability ratio, book-to-market ratio, annual average turnover rate, corporation nature, return on assets, and enterprise year as a control variable, these variables affect the company's future stock returns. I also control for time-fixed effects and industry-fixed effects of the regression[6].

For Table 3, column 1 and column 2 show the regression results of models (1) and (2), respectively. As can be seen from the table, the coefficient of the ESG score is -0.013, which is significant at the 1% level, indicating that the ESG score can significantly reduce the cost of equity capital of enterprises. The coefficient of the E score is -0.016, the coefficient of the S score is -0.015, and the coefficient of the G score is 0.071, which are all significant at the 1% level, indicating that the E score and S score can significantly reduce, and G score can significantly improve COE.

Table 3. ESG and the cost of equity

	(1)	(2)
	COE	*COE*
ESG score	-0.013***	
	(-3.204)	
E score		-0.016***
		(-4.347)
S score		-0.015***
		(-5.186)
G score		0.071***
		-13.641
Size	-0.002***	-0.003***
	(-8.026)	(-10.426)
Growth	0.000	0.000
	-0.307	-0.295
Lev	0.013***	0.012***
	-6.633	-6.549
M2B	0.000	0.000
	-1.164	-1.283
Turn	-0.002**	-0.002***
	(-2.421)	(-2.945)
SOE	0.003***	0.003***
	-5.896	-5.131
ROA	-0.017***	-0.016***
	(-3.294)	(-3.163)
FirmAge	0.000	-0.002**
	(-0.450)	(-2.191)
cons	0.139***	0.130***
	-19.745	-18.715
industry	Yes	Yes
year	Yes	Yes
N	4365	4365
F	33.498	36.779
R^2	0.397	0.425

For Table 4, column 1 shows the Dominance Statistics for each variable. Dominance Statistics can be interpreted as the marginal contribution of the variable to the determination coefficient. Columns 2 and 3 clearly show the contribution degree of each variable to the cost of equity financing. It can be seen from the data that the G score has the greatest influence on the cost of equity capital.

Table 4. The contribution degree of ESG to R^2

COE	Dominance Statistics	Standardized Dominance Statistics	Ranking
E score	0.0118	0.0277	6
S score	0.0111	0.0260	7
G score	0.0165	0.0387	4
Size	0.0275	0.0646	3
Growth	0.0001	0.0003	13
Lev	0.0072	0.0168	9
M2B	0.0022	0.0053	11
Turn	0.0009	0.0020	12
SOE	0.0044	0.0103	10
ROA	0.0088	0.0206	8
FirmAge	0.0122	0.0287	5
Set1	0.1819	0.4279	1
Set2	0.1407	0.3309	2

4.2 Comparison between state-owned and non-state-owned enterprises

Table 5. State-owned versus non-state-owned

	Non-state-owned enterprises		State-owned enterprises	
	(1)	(2)	(3)	(4)
	COE	*COE*	*COE*	*COE*
ESG score	-0.015**		-0.009	
	(-2.513)		(-1.612)	
E score		-0.016***		-0.010**
		(-2.912)		(-2.022)
S score		-0.015***		-0.019***
		(-3.221)		(-4.783)
G score		0.065***		0.077***
		(8.391)		(10.482)
Size	-0.002***	-0.003***	-0.003***	-0.003***
	(-4.213)	(-6.238)	(-6.822)	(-8.128)
Growth	0.000	0.000	-0.000	-0.000
	(0.963)	(1.004)	(-0.450)	(-0.607)
Lev	0.008***	0.007***	0.016***	0.016***
	(2.888)	(2.778)	(5.888)	(6.088)
M2B	-0.000	-0.000	0.000	0.000
	(-0.369)	(-0.489)	(0.898)	(1.065)
Turn	-0.002**	-0.003***	-0.001	-0.001
	(-2.491)	(-2.772)	(-0.632)	(-1.184)
ROA	-0.015**	-0.016***	-0.020**	-0.011
	(-2.396)	(-2.675)	(-2.113)	(-1.174)
FirmAge	0.001	-0.001	-0.003**	-0.003*
	(1.064)	(-0.920)	(-2.116)	(-1.843)
cons	0.126***	0.128***	0.158***	0.135***
	(11.673)	(12.017)	(15.673)	(13.469)
industry	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes
N	2178	2178	2187	2187
R^2	0.390	0.412	0.446	0.477

Compared with non-state-owned enterprises, domestic state-owned enterprises are closely related to the government. State-owned enterprises have advantages in policy protection and financing convenience. In addition, state-owned enterprises have fewer operating risks and lower financing costs, and they are favored by financial institutions and investors. Moreover, state-owned enterprises can timely grasp the information of national policies and actively adjust ESG investment to meet the requirements of the policies. On the other hand, non-state-owned enterprises, due to their cautious attitude towards ESG investment, receive relatively less additional policy support when financial institutions and investors are more conservative. Therefore, this part divides the samples into state-owned enterprises and non-state-owned enterprises according to the nature of property rights and

conducts regression according to models (3) and (4) to explore the relationship between ESG performance and the cost of equity capital under different property rights. The regression results are shown in columns (1) and (2) of Table 5.

For table 5, Columns 1 and 2 clearly show that the inhibition effect of ESG on COE in non-state-owned enterprises is greater than that in state-owned enterprises. The influence of the E score on COE for non-state-owned enterprises is greater than that of state-owned enterprises, the influence of the S score on COE for state-owned enterprises is greater than that of non-state-owned enterprises, and the influence of the G score on COE for state-owned enterprises is greater than that of non-state-owned enterprises. In general, however, the ESG score can significantly reduce a company's cost of equity in both state-owned enterprises and non-state-owned enterprises [7].

4.3 Comparison between manufacturing companies and non-manufacturing companies

On the other hand, companies in different industries should have different considerations. There are also big differences between manufacturing and non-manufacturing companies. Therefore, we divided the sample into manufacturing companies and non-manufacturing companies according to the difference in the manufacturing industry or not. We tested the relationship between their ESG performance and cost of equity capital according to models (3) and (4). The regression results are shown in columns (1) and (2) of Table 6.

For table 6, for the ESG score, E score, and G score, their impact on the cost of equity in the manufacturing sector is greater than that in the non-manufacturing sector, while the S score has a similar impact on the cost of equity in the manufacturing and non-manufacturing sectors. In general, however, the ESG score can significantly reduce a company's cost of equity in both manufacturing companies and non-manufacturing companies[8].

Table 6. Manufacturing companies versus non-manufacturing companies

	Non-manufacturing		Manufacturing	
	(1)	(2)	(3)	(4)
	COE	COE	COE	COE
ESG score	-0.008		-0.015***	
	(-1.313)		(-2.827)	
E score		-0.007		-0.022***
		(-1.244)		(-4.656)
S score		-0.016***		-0.014***
		(-3.782)		(-3.377)
G score		0.060***		0.083***
		(7.520)		(11.933)
Size	-0.003***	-0.003***	-0.002***	-0.002***
	(-6.638)	(-8.104)	(-4.571)	(-6.076)
Growth	0.000	0.000	-0.000	-0.000
	(1.488)	(1.426)	(-0.587)	(-0.561)
Lev	0.013***	0.015***	0.012***	0.010***
	(4.110)	(4.931)	(4.988)	(3.984)
M2B	0.000	0.000	-0.000	-0.001
	(1.276)	(1.382)	(-0.959)	(-1.342)
Turn	-0.000	-0.000	-0.003***	-0.003***
	(-0.003)	(-0.225)	(-3.111)	(-3.513)
SOE	0.002**	0.002**	0.004***	0.004***
	(2.539)	(1.993)	(5.594)	(5.151)
ROA	-0.038***	-0.035***	-0.013**	-0.014**
	(-3.832)	(-3.579)	(-1.975)	(-2.259)
FirmAge	-0.003**	-0.004***	0.001	-0.001
	(-2.393)	(-2.815)	(1.228)	(-0.998)
cons	0.160***	0.152***	0.127***	0.116***
	(16.232)	(15.564)	(13.649)	(12.675)
industry	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes
N	1851	1851	2514	2514
R^2	0.482	0.500	0.334	0.374

4.4 Robust Check

The robustness test examines the robustness of the evaluation method and the explanatory ability of indicators, that is, whether the evaluation method and indicators still maintain a consistent and stable interpretation of the evaluation results when some parameters are changed.

To further avoid the possible false conclusions of specific samples, the MPEG model and PEG model are used in this section to calculate the dependent variable COE, and the Bloomberg ESG score was used as the independent variable for regression. A company's cost of equity calculated according to the MPEG model is represented by COE_MPEG, while a company's cost of equity calculated according to the PEG model is represented by COE_PEG. COE_MPEG and COE_PEG are regressed according to equations (3) and (4). The results are shown in Table 7.

Since the impact of the ESG score on the cost of equity is time-delayed, this paper uses the ESG score with one year lag to replace the original ESG score. The results are shown in column (3) of Table 7. As can be seen from the table, no matter the replacement variable or the lag, the results are consistent with the baseline regression[9].

Table 7. Robustness check

	Replace the explained variable		Lag one year
	(1)	(2)	（3）
	COE_MPEG	*COE_PEG*	*COE_CAPM*
ESG score	-0.081***	-0.061***	
	(-3.216)	(-4.882)	
L.ESG score			-0.018***
			(-3.502)
Size	0.009***	0.005***	-0.002***
	(4.921)	(5.661)	(-7.113)
Growth	-0.000	-0.001*	0.000*
	(-0.466)	(-1.669)	(1.662)
Lev	0.017	0.034***	0.013***
	(1.397)	(5.810)	(5.480)
M2B	-0.000	0.000	0.000*
	(-0.139)	(0.174)	(1.703)
Turn	0.013***	0.002	-0.001
	(3.051)	(1.072)	(-1.605)
SOE	-0.018***	-0.010***	0.003***
	(-5.074)	(-5.720)	(5.067)
ROA	0.019	-0.010	-0.016**
	(0.587)	(-0.645)	(-2.485)
FirmAge	-0.001	0.008***	0.001
	(-0.178)	(2.679)	(0.713)
cons	-0.087*	-0.047**	0.128***
	(-1.948)	(-2.129)	(14.548)
industry	Yes	Yes	Yes
year	Yes	Yes	Yes
N	4365	4341	3063
R^2	0.116	0.184	0.365

4.5 Endogeneity test

The instrumental variable (IV) two-stage regression was carried out in two stages. In the first stage, the explanatory variable carries out regression to the instrumental variable to get the fitting value (estimated value) of the explanatory variable; In the second stage, the obtained fitting value of the explanatory variable is used to regression the explained variable, which is the regression result of 2SLS (two stages least square).

When performing a 2SLS regression with IV, the IV needs to be tested. The first is the unidentifiable test. The unidentifiable test is to see if the number of IVs is less than the number of endogenous explanatory variables. The statistics used are the Kleibergen-Paap rk LM (K-P LM) statistics. Here, a p-value less than 0.01 indicates that the null hypothesis of "insufficient instrumental variable identification" is significantly rejected at the 1% level, that is, a p-value no greater than 0.1 is required. The second is the weak IV test. Weak IV means that IV is weakly correlated with endogenous explanatory variables. Stock and Yogo (2005) put forward that Stata would give a critical value in ivreg2 and suggest that if the value is greater than 10, there is no weak IV. Kleibergen-Paap Wald rk F (K-P Wald F) statistic is the statistics of the weak IV test Stock and Yogo (2005) give their thresholds.

To overcome the endogenous problem of causality between the ESG score and COE, this paper uses the lag term of ESG scores as an instrumental variable for two-stage regression. It can be seen from the Table 8 that the statistical value of K-P LM is 573.798, and the p-value is less than 0.01, indicating that the instrumental variable passes the unidentifiable test. K-P Wald F value is 3,462.490 and the critical value of Stock-Yogo is 16.380, passing the weak instrumental variable test. The number of instrumental variables did not exceed the number of endogenous variables, so it passed the over-recognition test. To sum up, the tool variables selected in this paper are appropriate. It can be seen from the regression results of the second stage that the coefficient of the ESG score is significantly negative, again verifying the hypothesis of the paper[10].

Table 8. Instrumental variable two-stage regression

	(2)	(2)
	ESG score	*COE*
L.ESG	0.927***	
	（58.842）	
ESG score		-0.020***
		(-3.889)
cons		0.125***
		(15.426)
Controls	Yes	Yes
industry	Yes	Yes
year	Yes	Yes
N	3063	3063
K-P LM	573.798	573.798
	[0.000]	[0.000]
K-P Wald F	3462.490	3462.490
	{16.380}	{16.380}
F	3462.490***	443.276***

Note: *, ** and *** respectively represent the significance at the level of 10%, 5% and 1%. The t value is in (), and the p-value of the statistic is in []. The value in {} is the critical value under the 10% level of the Stock-Yogo test. F is the F-test value of the first stage, which is used to judge whether the regression of the first stage is significant.

5. Conclusion

My main finding is to provide evidence that ESG scoring can significantly reduce the cost of equity capital, which is mainly measured by the CAPM model. In addition, this study also separately studied the impact of environmental, social and government ratings on the cost of equity capital of a company in ESG. It was found that government scores increased the cost of equity capital, while environmental scores and social scores reduced the cost of equity capital. Moreover, government ratings had the most significant impact of the three, while environmental and social ratings had roughly the same

impact. When state-owned enterprises and non-state-owned enterprises are considered separately and manufacturing companies and non-manufacturing companies are considered separately, the result is the same, which eliminates the possibility that factors such as state-owned enterprises and non-state-owned enterprises and manufacturing and non-manufacturing companies have different impacts on the cost of equity capital of enterprises.In addition, I also use the MPEG model and PEG model instead of the CAPM model to calculate the cost of equity capital, and the results are robust. Due to the lag of the impact of ESG score on the cost of equity capital of a company, this study also reached a conclusion consistent with the benchmark regression by lagging the explained variables for one year.My research results may have some guiding significance for Chinese listed companies that just start to pay attention to ESG scores. For listed enterprises in China at present, ESG scoring is still a new concept and its impact on enterprises is still unclear. Creditors and shareholders are the main providers of corporate funds, representing debt funds and equity funds respectively. Equity capital is the first and necessary and occupies a very important position in the enterprise capital. Therefore, the effective reduction of the company's cost of equity capital has very important guiding significance for the company. In view of the findings of this study, ESG score can effectively reduce the cost of equity capital of a company, indicating that listed company managers should pay attention to the ESG score of an enterprise.Finally, the research of this paper has certain guiding significance for government decision-makers. Recently, many listed companies do not pay attention to environmental protection and social donations. The results of this study may provide some guidance for the behavior of government enterprises. For example, the government can make more listed companies pay attention to the positive impact of ESG scores, thus promoting more listed companies to make more positive impacts on the environment, society and the national government.

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