Efeitos das práticas de ESG no custo de capital das empresas brasileiras

Effects of ESG practices on the cost of capital of Brazilian companies

Efectos de las prácticas ESG en el costo de capital de las empresas brasileñas

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Resumo: O reconhecimento da necessidade de ações para fazer frente aos impactos das mudanças climáticas, de diversidade e regras de *compliance* leva a um aumento dos investimentos pelas empresas que adotam práticas de sustentabilidade que vêm se tornando relevantes para as decisões de investidores. No Brasil, a percepção sobre o valor da adoção das práticas de ESG é mais recente e vem crescendo, havendo o reconhecimento de que o desenvolvimento econômico deve ocorrer com avanço sustentável no país. Este estudo verifica se a adoção de práticas de sustentabilidade acarreta numa redução do custo de capital de 96 empresas – não financeiras – brasileiras, de capital aberto, e com informações de pontuação ESG de, ao menos, 3 anos no período de 2016 a 2020 utilizando regressões múltiplas lineares por *pooled* ou painel. Verifica-se a existência de uma relação negativa entre o componente ambiental e o custo do capital de terceiros que confirma uma preocupação crescente dos países sobre as questões ambientais. Porém com a não ratificação da hipótese de redução de custo de capital próprio, indica-se que os credores

possuem maior sensibilidade às práticas ambientais das empresas que seus acionistas. Dessa forma, diferentemente dos países desenvolvidos, empresas e investidores brasileiros ainda não conseguem perceber os benefícios financeiros advindos da adoção de práticas de sustentabilidade, apontando oportunidades para tais investimentos.

KEYWORDS
Sustainability. Cost of capital. ESG scores.

Abstract: The acknowledgement of the need for actions to face the impacts of climate change, diversity and compliance rules leads to an increase in investments by companies that adopt sustainability practices that are becoming relevant for investor's decisions. In Brazil, the perception of the value of adopting ESG practices is more recent and has been growing, while recognizing that economic development must occur with sustainable progress in the country. This study verifies whether the adoption of sustainability practices leads to a reduction in the cost of capital of 96 Brazilian – non-financial – companies, publicly traded, and with ESG score information for at least 3 years, within the period from 2016 to 2020, using linear multiple regressions by pooled or panel. There is a negative relationship between the environmental component and the cost of third-party capital, which confirms a growing concern on the part of countries about environmental issues. However, with the non-ratification of the hypothesis of reducing the cost of equity capital, it is indicated that creditors are more sensitive to the environmental practices of companies than their shareholders. Thus, unlike developed countries, Brazilian companies and investors are still unable to perceive the financial benefits arising from the adoption of sustainability practices, pointing to opportunities for such investments.

PALABRAS CLAVE
Sostenibilidad. Costo de capital. Puntajes ESG.

Resumen: El reconocimiento de la necesidad de acciones para enfrentar los impactos del cambio climático, la diversidad y el cumplimiento de las normas, conduce a un aumento de las inversiones de las empresas que adoptan prácticas de sostenibilidad que se vuelven relevantes para las decisiones de los inversores. En Brasil, la percepción del valor de adoptar prácticas ESG es más reciente y ha ido creciendo, con el reconocimiento de que el desarrollo económico debe ocurrir con un progreso sostenible en el país. Este estudio verifica si la adopción de prácticas de sostenibilidad conduce a una reducción en el costo de capital de 96 empresas brasileñas -no financieras-, que cotizan en bolsa y con información de puntaje ESG durante al menos 3 años en el período de 2016 a 2020 utilizando regresiones lineales múltiples por pool o panel. Existe una relación negativa entre el componente ambiental y el costo de capital de terceros, lo que confirma una creciente preocupación por parte de los países por los temas ambientales. Sin embargo, con la no ratificación de la hipótesis de reducción del costo del capital social, se indica que los acreedores son más sensibles a las prácticas ambientales de las empresas que sus accionistas. Así, a diferencia de los países desarrollados, las empresas y los inversores brasileños todavía no pueden percibir los beneficios financieros derivados de la adopción de prácticas de sostenibilidad, lo que apunta a oportunidades para tales inversiones.

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

168

Introduction

Over the last decade, there was an increase in investments by companies that adopt sustainability practices. Communicating this adhesion to the market occurs through the disclosure of their Environmental, Social, and Corporate Governance (ESG) scores. According to the Organisation for Economic Co-operation and Development (OECD), in 2018 such investments amounted to US\$ 11 trillion in the United States and US\$ 17 trillion in Europe. In that same year, Morgan Stanley carried out a survey with 118 institutional investors, and 70% confirmed considering sustainability criteria when identifying companies for capital contribution purposes (Morgan Stanley, 2018; Boffo & Patalano, 2020).

The market's increased interest in these companies stems from changes - in the planet and in society -, which have mainly escalated since the beginning of the 21st century. Among them are: a) strong climate changes; b) diversity of consumers who want to see themselves represented in the institutions; and c) perception of financial benefits by observing compliance rules. Another relevant aspect is investors' awareness of the importance of achieving long-term returns, enabling the continuity and sustainability of businesses. Moreover, due to recent financial scandals, more companies seek to comply with local, environmental, and social regulations. This attitude, in addition to being a response to authorities' pressure, signals to stakeholders a positive image of organizations' efforts in practicing corporate responsibility (Alareeni & Hamdan, 2020).

Climate change affects not only people's lives, but also the bottom line of companies and economies. Therefore, environmental risk management is a growing market demand, whose disclosure must occur in an increasingly standardized way (SEC, 2022).

Failure to adopt ecologically responsible conducts implies legal and financial penalties to organizations. Examples include the oil spill from British Petroleum's (BP) Deepwater Horizon platform, in the Gulf of Mexico (James, 2010), as well as the Vale do Rio Doce (Vale) dam burst in the Brazilian town of Brumadinho (Folha de São Paulo, 2019). On the contrary, the effective adoption of sustainability practices by companies, in addition to reducing losses, attracts investors' attention and minimizes conflicts between stakeholders (Garcia, Mendes-da-Silva & Orsato, 2017; Giglio, Kelly & Stroebel, 2021).

As for the social aspect, we highlight the arrival of generation Y or Millennials - born between 1981 and 1996 - to the market. This generation has characteristics associated with a society more technologically connected. They consider diversity an assumption in their professional relationships, and wish to work in purposeful organizations. Generation X - born between 1965 and 1980 - supports this change with the view that the adoption of ESG practices provides companies with higher returns in the long term, as well as a better market reputation (Spencer, Kearns & Denys, 2019). Amiraslani *et al*. (2022) highlight the possibility of these practices affecting the pricing and demand for securities issued by such firms.

The governance dimension gains an even higher relevance, given the 2008 global crisis and the succession of recent corporate scandals. We can mention the case of the company Theranos, whose founder and chief executive Elizabeth Holmes, as well as its former president Ramesh Balwani, were accused of making shareholders believe in the false information that their main product was able to analyze blood through a portable device (SEC, 2018). Another example refers to Daimler having installed an exhaust with illegal technology in hundreds of thousands of Mercedes-Benz cars. After it was discovered,

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

169

the company was forced to recall 670,000 cars in Europe, in 2018 (Taylor, 2018).

These facts highlight the deficiencies of existing governance mechanisms. In response, markets improve corporate governance tools. An example are the guidelines for corporate governance best practices - focusing on the relationship with stakeholders (OECD, 2015), adoption of quality standards, and sustainability tools (Gnan *et al*., 2013). Indeed, such mechanisms assume an increasingly important role in mitigating conflicts, as well as financial problems (Zeidan & Müllner, 2015; Bravo-Urquiza & Moreno-Ureba, 2021).

In Brazil, companies and government's perception on the value of adopting ESG practices is more recent. In 2021, the Brazilian Association of Financial and Capital Market Entities (ANBIMA) found that, among 265 asset managers: a) 86% said this topic had gained prominence in the last 12 months; and b) 90% believed that it would gain more relevance in the next 12 months (ANBIMA, 2021). In turn, the Brazilian state has committed to achieving carbon neutrality by 2050, by understanding that economic growth will occur through sustainable progress and energy transition (Tao *et al*., 2022).

In fact, ESG practices stand out from the moment stakeholders and investment fund managers identify a positive relationship between higher scores and company performance. Such achievement is associated with operational performance, higher returns, and lower risks (Krüger, 2014; Li *et al*., 2021). However, there are other benefits associated with improving ESG scores, such as reduced cost of capital for firms. There are studies that analyze this negative relationship for each cost component - weighted average cost of capital (WACC), cost of equity (CoE) and cost of debt (CoD) (Jiménez & Zorio-Grima, 2021; Raimo *et al*., 2021; Yu *et al*., 2021). Nevertheless, the results are not unanimous.

Some authors, on the contrary, point to a positive relationship (Zainon *et al*., 2020; Gjergji *et al*., 2021), which encourages further analyses.

In view of the above, this study intended to check if the adoption of sustainability practices, through ESG scores, leads to a reduction in companies' cost of capital. Such costs refer to WACC, CoE, and CoD. The hypothesis was: *H$_1$- The higher the ESG score, the lower the companies' cost of capital*. To that end, we considered a final sample of 96 Brazilian companies, non-financial, publicly traded. Data were obtained between 2016 and 2020, from Bloomberg, Capital IQ Pro (CIQ), and Federal Reserve Economic Data (FRED) databases.

Among this study 's differentials, we highlight: a) the analysis of companies in the emerging Brazilian market; b) use of the credit default swap rate as a proxy for country risk – for calculating CoE. Regarding its main contributions, we mention the increased visibility of adopting ESG practices on companies' cost of capital, in a scenario of relevant financial impacts, stemming from environmental, social, and regulatory issues.

Theoretical elements of the research

In his seminal article, Freeman (1984) presented the stakeholder theory, showing that a business has several stakeholders - distinct groups and individuals that bet on it, such as owners, creditors, employees, customers, and ultimately, the society itself. Since all of them are equally important to the company, trade-offs between the parties should be avoided. Value creation for one also contributes to the others. Therefore, the company must ensure a balance in meeting the interests of all stakeholders.

More recently, a self-regulatory practice has emerged in companies, which also contributes to their social goals - Corporate

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

REUNIR

170

Social Responsibility (CSR). It approaches social responsibility as a duty of businessmen to align decisions and actions to society's targets and values (Bowen, 1953; Carroll, 1999). This means that CSR emphasizes a single responsibility, its social orientation. On the other hand, the stakeholder theory considers the responsibilities with the other stakeholders in the business - return to owners and creditors, customers and employees' satisfaction, compliance with suppliers, etc. (Freeman *et al.,* 2010).

Indeed, such responsibilities are inseparable. To maximize profits, companies must offer products and services that customers want. Strong relationships with motivated suppliers and employees achieve the support of communities, which, as a result, allow companies to flourish. Therefore, good stakeholder management enables creating sustainable long-term value. In addition, this allows companies to attract better prepared employees, gain consumer trust, increase their visibility, get external financing more easily, and strengthen their reputation in the society where they operate (Freeman *et al*., 2010; Freeman & Dmytriyev, 2020; Gjergji *et al.,* 2021).

Currently, companies incorporate ESG practices into their businesses to strengthen their relationship and create value for stakeholders. In exchange, investors accept lower returns, resulting in a lower cost of capital to the company (Sharfman & Fernando, 2008; Peng & Isa, 2020). It is worth noting that the cost of equity is directly proportional to the firm's level of indebtedness (Modigliani & Miller, 1958; Copeland, Weston & Shastri, 2014). These arguments support hypothesis H_1 - *The higher the ESG score, the lower the companies' cost of capital.*

The discussion on the company's function is not yet settled. There are questions on whom the company should create value for, if only for its shareholders or for all its stakeholders. According to Friedman (1970), companies' social responsibility is to increase their profits, thus maximizing the wealth of their owners. Hence, CSR investments are associated with costs with no direct return, perceived as less favorable to shareholders. The agency theory, presented by Jensen and Meckling (1976), also addresses conflicts of interest between managers (agents) and owners (principals). For the authors, companies are a set of contractual relationships between individuals.

For Peng and Isa (2020), until recently CSR activities were considered an agency problem that expropriates shareholders' wealth. The executive might spend his/her time and resources on CSR activities, but not the employer's time, who hired him/her to make profit for the company. It turns out that minimizing conflicts between stakeholders adds value (Shahbaz *et al*., 2020; Azmi *et al*., 2021) and reduces the firms' cost of capital (Benlemlih, 2017; Wang *et al*., 2021), which confirms our hypothesis.

Mitigation of agency conflicts between the parties occurs, among other possibilities, through information balance. The opposite, informational asymmetry, takes place when some economic agents have more information than others - managers versus owners, for example (Akerlof, 1970). When companies disclose information about their ESG practices, they reduce information asymmetry and provide more security to stakeholders (Houqe *et al*., 2020).

Such fact reduces other agency costs, such as elaboration of contracts between the principal and the agent; monitoring agents' activities by the principal; and residual losses resulting from the decrease of principal's wealth, due to possible disagreements between the agent's decisions and those that would maximize the principal's wealth

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

171

(Gjergji *et al.,* 2021). In addition, companies with better ESG scores and disclosure of CSR practices are better rated, face less financial constraints, and have lower cost of capital (Jiménez & Zorio-Grima, 2021; Wong *et al*., 2021). These arguments also confirm our research hypothesis.

In turn, the signaling theory clarifies how decision makers interpret and react to the situation where available information is incomplete and asymmetrically distributed among market agents (Spence, 1973). Verrechia (2001) adds to this concept by stating that organizations, when making certain choices, send information to the market. Since managers have more access to information than other stakeholders, the latter interpret additional information to financial statements as a positive signal. In the case of disclosing ESG practices, such information enables a better analysis of the risks associated with companies' operational activities.

As a result, higher ESG scores improve their image, enabling the attraction of consumers who care about sustainability issues, and of investors who are willing to pay more for their securities, since they minimize the risks of government regulations. In addition, firms that have better corporate governance practices reduce their cost of capital and financial difficulties (Gillan, Koch & Starks, 2021; Wong & Zhang, 2022), thus supporting the main hypothesis of this study.

As for the control variables, empirical studies show conflicting relations between size (SIZ), leverage (LEV), and the book-to-market value (BMV) ratio, and the specific types of cost of capital - CoE and CoD - and their weighted average (WACC) (Ebihara *et al*., 2014; Hmaittane, Bouslah & M'Zali, 2019; Houqe, Ahmed & Richardson, 2020; Zainon *et al*., 2020; Eliwa, Aboud & Saleh, 2021; Jiménez & Zorio-Grima, 2021; Luo, 2022; Raimo *et al*., 2021a,b; Gholami, Sands & Shams, 2022). Therefore, both positive and negative relationships are possible. As for the variables equity market value (EMV) (Sharfman & Fernando, 2008; Yu *et al*., 2021) and return on assets (ROA) (Magni, 2015; Gerwanski, 2020; Houqe *et al*., 2020; Raimo *et al*., 2021a), there is evidence of negative relationships between them and the cost of capital.

Table 1 presents a summary of the results of similar studies that investigated the impact of ESG on firms' weighted average cost of capital. There are conflicting, or not statistically significant results, on the relationship between ESG, as well as its individual scores, and WACC. This fact justifies further analysis on this topic. According to Cornell and Damodaran (2020), a company's risk measures the uncertainty about its future results, and is captured by the cost of capital. There are companies that benefit from being socially responsible, but there are others for which the adoption of ESG practices generates operating costs without compensation benefits, such as the reduction of their cost of capital. As for the control variables, there is a constant negative relation between the level of leverage and companies' WACC.

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

172

REUNIR

Table 1
Results from other empirical studies– WACC

Variables	SE	Theories	Sharfman & Fernando (2008)		Zainon et al. (2020)		Gjergji et al. (2021)		Gholami et al. (2022)	
			Signal	Sig	Signal	Sig	Signal	Sig	Signal	Sig
ESG	–	(a)	n/a	n/a	n/a	n/a	+	10%	–	1%
E	–	(a)	–	1%	+	n/s	n/a	n/a	n/a	n/a
S	–	(a)	n/a	n/a	+	1%	n/a	n/a	n/a	n/a
G	–	(a)	n/a	n/a	+	n/s	n/a	n/a	n/a	n/a
SIZ	+/–	(b)	n/a	n/a	+	1%	–	n/s	+	1%
LEV	+/–	(b)	–	1%	n/a	n/a	–	5%	–	1%

Notes: SE = expected signal; n/a = Not applicable; n/s = Not significant; Sig = Level of significance; ESG = Environmental, Social responsibility, and Corporate Governance global score; E = Environmental Score; S = Social responsibility score; G = Corporate governance score; SIZ = Size; LEV = Leverage; (a) Theories = *stakeholder*, agency, information asymmetry, and signaling (b) Expected signals are those presented in similar empirical studies

Table 2 summarizes the results of other empirical studies that check the effects of ESG scores on organizations' cost of equity. Unlike Table 1, all of them show a negative and statistically significant relationship, at 1% level, between the overall ESG score and CoE. We observe the absence of this analysis for its individual scores, strengthening the relevance of our study. It is important to know the effect of each ESG dimension on companies' CoE, in order to check on which they should focus. As for the control variables, there is an adherence of the results to the expected signs of size (SIZ) and leverage (LEV), and of the ratio between book value and market value (BMV).

Table 2
Results from other empirical studies – CoE

Variables	SE	Theories	Hmaittane et al. (2019)		Jiménez & Zorio-Grima (2021)		Raimo et al. (2021b)		Yu et al. (2021)	
			Signal	Sig	Signal	Sig	Signal	Sig	Signal	Sig
ESG	–	(a)	–	1%	–	1%	–	1%	–	1%
E	–	(a)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S	–	(a)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
G	–	(a)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
SIZ	+/–	(b)	–	n/s	+	10%	–	1%	n/a	n/a
LEV	+/–	(b)	n/a	n/a	+	n/s	+	1%	+	1%
BMV	+/–	(b)	+	1%	+	n/s	–	1%	n/a	n/a

Notes: SE = expected signal; n/a = Not applicable; n/s = Not significant; Sig = Level of significance; ESG = Environmental, Social responsibility, and Corporate Governance global score; E = Environmental Score; S = Social responsibility score; G = Corporate governance score; SIZ = Size; LEV = Leverage; BMV = Book value/Market value ratio; (a) Theories = *stakeholder*, agency, information asymmetry, and signaling (b) Expected signals are those presented in similar empirical studies.

In turn, Table 3 shows the result of checking the relationship between ESG and the cost of debt capital from other empirical studies. Similarly to Table 2, all studies show a negative and statistically significant relationship, at 1% or 5% levels, between the overall ESG score and CoD. We mention a single study that analyzes this relationship, considering the individual scores of each dimension (Houqe et al., 2020). Regarding the control variables, we highlight the positive relation between leverage (LEV) and CoD,

and negative between size (SIZ) and CoD.

Table 3
Results from other empirical studies – CoD

Variables	SE	Theories	Gerwanski (2020)		Houqe et al. (2020)		Eliwa et al. (2021)		Raimo et al. (2021a)	
			Signal	**Sig**	**Signal**	**Sig**	**Signal**	**Sig**	**Signal**	**Sig**
ESG	–	(a)	–	1%	–	1%	–	5%	–	1%
E	–	(a)	n/a	n/a	–	1%	n/a	n/a	n/a	n/a
S	–	(a)	n/a	n/a	–	1%	n/a	n/a	n/a	n/a
G	–	(a)	n/a	n/a	–	1%	n/a	n/a	n/a	n/a
SIZ	+/–	(b)	–	n/s	–	n/s	–	1%	–	1%
LEV	+/–	(b)	+	1%	+	n/s	+	1%	+	1%
BMV	+/–	(b)	n/a	n/a	–	1%	n/a	n/a	+	1%

Notes: SE = expected signal; n/a = Not applicable; n/s = Not significant; Sig = Level of significance; ESG = Environmental, Social responsibility, and Corporate Governance global score; E = Environmental Score; S = Social responsibility score; G = Corporate governance score; SIZ = Size; LEV = Leverage; BMV = Book value/Market value ratio; (a) Theories = *stakeholder*, agency, information asymmetry, and signaling (b) Expected signals are those presented in similar empirical studies.

Finally, regarding the Covid-19 pandemic, it started in China in late 2019, but its impact on other countries occurred from 2020 onward. According to Ke (2022) and Rizvi *et al*. (2022), its outbreak resulted in economic pressures that will persist for most companies. Among them is the increase in the cost of equity. For Bai and Ho (2022), on the other hand, companies with high indebtedness levels are even more vulnerable to the pandemic and exposed to greater risks, thus raising the cost of their debt.

Methodological elements of the research

The objective of this study was to check if the adoption of sustainability practices, expressed by ESG scores, implies a reduction of companies' cost of capital (WACC, CoE, and CoD). Therefore, our hypothesis was: *H_1- The higher the ESG score, the lower the companies' cost of capital.*

We used a quantitative approach, which involved collecting data to test the hypothesis, based on numerical measuring and statistical analysis, to establish patterns and prove theories (Marconi & Lakatos, 2021).

Secondary data were obtained from Capital IQ and Bloomberg databases. Hypothesis H_1 was checked by means of a descriptive and correlation analysis, as well as by the multivariate linear regression model presented in Equation 1. We used the Stata econometric software.

The initial sample comprised 230 companies, non-financial, and with positive net equity, whose shares were traded in Brazil, Bolsa, Balcão (B3), from 2016 to 2020. From this initial sample, 134 firms that did not have ESG scores for at least 3 years were excluded, which resulted in a final sample of 96 companies. We got data from Bloomberg, Capital IQ Pro (CIQ) and Federal Reserve Economic Data (FRED) databases. The description of the variables is shown in Table 4. We highlight that the year 2020 was affected by the Covid-19 pandemic, being controlled through a dummy variable.

$$CC_{it} = \alpha_0 + \beta_1 ESG_{it} + \beta_2 Control \ (1)$$
variables$_{it}$ + ε_{it}

where: Dependent variables – CC = Cost of capital, being the Weighted Average Cost of Capital (WACC), Cost of Equity (CoE) and Cost of Debt (CoD); Independent variables – ESG = global and individual scores, being ESG score (ESG), Environmental score (E), Social Responsibility score (S), and Corporate governance score (G); Control variables – Size (SIZ), Leverage (LEV), and Book value to Market value ratio (BMV); ε = Term of Error; i = Company; t = Year.

Descriptive statistics aims to identify central values and dispersions of variables in a study. Correlation analysis, in turn, has two main goals: i) to identify the type of correlation, whether positive or negative, between dependent and independent variables, anticipating a potential confirmation of the study hypothesis; and ii) to investigate the existence of a potential high multicollinearity between the explanatory variables - independent and control. We also checked the statistical significance of correlation coefficients (Fávero & Belfiore, 2019).

As for regression, initially we did a test to check the most appropriate model - with panel data or pooled data. The regression model with panel data consists of an analysis of the same group of individuals over time. In the pooled model, on the other hand, data are grouped and a regression is estimated, disregarding the cross-sectional and time-series nature (Fávero & Belfiore, 2019; Gujarati, Porter & Pal, 2019; Wooldridge, 2020). We identified that the most suitable model for WACC and CoE was pooled, while for CoD it was panel data with fixed effects.

The assumption tests in the pooled model were: i) linearity of coefficients; ii) lack of high multicollinearity between the explanatory variables; iii) normality; and iv) homoscedasticity of the residues. Regarding the normality of residuals, the Gauss-Markov theorem demonstrates that even if they do not have a normal distribution, the ordinary least squares (OLS) estimator is the best unbiased linear estimator (Gujarati *et al.*, 2019; Wooldridge, 2020). As for the regression model with panel data, we added the following tests on the residues: v) lack of serial autocorrelation; and vi) identification of the type of effect - fixed or random (Hausman).

Table 4
Variable description

Variables	Description	Signal	Formula	Components	Ref.	Source
Dependent Variables						
WACC	Weighted average cost of capital	n/a	WACC = [(EMV / CSV) * CoE] + [TDBV / CSV) * CoD] CSV = EMV + TDBV	EMV = Equity market value = Total number of tradable shares * share price CSV = Capital structure value CoE = Cost of equity TDBV = Total debt book value = Sum of short and long-term debts CoD = Cost of debt	(a)	CIQ
CoE	Cost of equity	n/a	CoE = CAPM = R_f + Beta (R_m – R_f) + CR Beta = $COV_{Rj,Rm}$ / VAR_{Rm}	CoE = Cost of equity CAPM = Capital asset pricing model R_f = Risk free rate = Risk-free rate of the United States Treasury Bond with a minimum term of 10 years, obtained on the last business day of each year	(b)	R_f: FRED CR: IPEA CIQ: All

				Beta = Systemic risk component of the share COV = Covariance VAR = Variance R_j = Monthly return of the share, obtained in the last 60 months R_m = Monthly return of the share market = S&P 500, obtained in the last 60 months (k) CR = Country risk = EMBI+, obtained on the last business day of each year EMBI+ = Emerging markets bond index plus		others
CoD	Cost of debt	n/a	CoD = IDR * (1– IT) IDR = IE / TDBV	CoD = Cost of debt IDR = Interest debt rate IT = Income taxes = 34% IE = Interest expenses TDBV = Total debt book value	(c)	CIQ
Independent variables						
ESG	ESG score	–		Scores range from 1 to 100	(d)	Bloomberg
E	Environmental score	–		Scores range from 1 to 100	(e)	Bloomberg
S	Social score	–	Social responsibility score	Scores range from 1 to 100	(f)	Bloomberg
G	Governance score	–	Corporate governance score	Scores range from 1 to 100	(f)	Bloomberg
Control variables						
SIZ	Size	+/–	SIZ = ln (TA)	Ln = Neperian logarithm TA = Total assets	(g)	CIQ
LEV	Leverage	+/–	LEV = TDBV / TA	TDBV = Total debt book value TA = Total assets	(h)	CIQ
BMV	Book to market ratio	+/–	BMV = EBV / EMV	EBV = Equity book value EMV = Equity market value	(i)	CIQ
COV	Covid-19	+	COV = Dummy	0 = If the year is 2016, 2017, 2018, or 2019 1 = If the year is 2020	(j)	n/a

Notes: Ref. = References; n/a = Not applicable; CIQ = Capital IQ PRO (S&P), FRED = Federal Reserve St. Louis

(a) Sharfman & Fernando (2008); Zainon *et al.* (2020); Gjergji *et al.* (2021); Gholami *et al.* (2022)

(b) Richardson & Welker (2001); Sharfman & Fernando (2008); El Ghoul *et al*. (2011); Clarkson *et al.* (2013); Ng & Rezaee (2015); Hmaittane *et al.* (2019); Jiménez & Zorio-Grima (2021); Raimo *et al.* (2021b); Yu *et al.* (2021)

(c) Sharfman & Fernando (2008); Gerwanski (2020); Hamrouni, Uyar & Boussaada (2020); Houqe *et al.* (2020); Eliwa *et al.* (2021); Raimo *et al.* (2021a)

(d) Gerwanski (2020); Hamrouni *et al.* (2020); Houqe *et al.* (2020); Eliwa *et al.* (2021); Jiménez & Zorio-Grima (2021); Gjergji *et al.* (2021); Raimo *et al.* (2021a); Raimo *et al.* (2021b); Gholami *et al*. (2022)

(e) Sharfman & Fernando (2008); Ng & Rezaee (2015); Hamrouni *et al.* (2020); Houqe *et al.* (2020); Zainon *et al.* (2020)

(f) Ng & Rezaee (2015); Hamrouni *et al.* (2020); Houqe *et al.* (2020); Zainon *et al.* (2020)

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

176

REUNIR

(g) Ghoul *et al.* (2011); Clarkson *et al.* (2013); Hmaittane *et al.* (2019); Gerwanski (2020); Houqe *et al.* (2020); Zainon *et al.* (2020); Eliwa *et al.* (2021); Jiménez & Zorio-Grima (2021); Gjergji *et al.* (2021); Raimo *et al.* (2021a); Raimo *et al*. (2021b); Gholami *et al.* (2022)

(h) Richardson & Welker (2001); Sharfman & Fernando (2008); Ghoul *et al.* (2011); Ng & Rezaee (2015); Gerwanski (2020); Houqe *et al.* (2020); Eliwa *et al.* (2021); Jiménez & Zorio-Grima (2021); Gjergji *et al.* (2021); Raimo *et al.* (2021a); Raimo *et al.* (2021b); Yu *et al.* (2021); Gholami *et al.* (2022)

(i) Clarkson *et al.* (2013); Jiménez & Zorio-Grima (2021)

(j) Bai & Ho (2022); Ke (2022); Rizvi *et al.* (2022)

(k) For calculating CoE or CAPM, the annual market return (R_m) is obtained by the ratio of the means of the last 12 months of the S&P500 index. To calculate the annual betas, market returns (S&P500) of the last 60 months are considered.

Results and discussion

Table 5 presents the descriptive statistics of the sample data. We can see that, on average, the cost of debt (CoD - 0.0628) is lower than the cost of equity (CoE - 0.1290), and this is higher than the weighted average cost (WACC - 0.0967), given the tax benefit of debts, among other reasons. Regarding the observations, there is a larger amount of CoD data than of CoE and WACC, due to the accounting origin of the former. Not all firms in the sample showed market value of their equity.

On ESG metrics, the scores of the governance dimension (G - 59.09) are higher than the others - environment (E - 35.29) and social (S - 34.46), with wider range in environmental scores (E - 18.72). Indeed, Brazil has a legislation focused on corporate governance mechanisms for a longer time, more recently oriented to social and environmental practices (B3, 2022).

As for control variables, firms have, on average, US$ 8,923 million in total assets (SIZ), with the smallest having US$ 47.84 million. Companies' mean degree of leverage (LEV) is 0.3348, with only 3 companies having almost zero debt. On the other hand, the book-to-market value of equity (BMV) ratio is 0.6953.

Table 5
Statistical description

Variable	Obs.	Mean	Median	Std. deviation	Minimum	Maximum
WACC	446	0.0967	0.0762	0.0655	0.0094	0.5568
CoE	453	0.1290	0.1003	0.0981	0.0021	0.8443
CoD	467	0.0628	0.0482	0.0633	0.0000	0.9132
ESG	472	42.16	42.52	11.83	13.80	74.44
E	442	35.29	34.94	18.72	0.48	79.49
S	471	34.46	34.52	14.64	5.80	78.95
G	472	59.09	59.21	7.01	18.39	89.86
SIZ (in USD million)	480	8,923.22	2,865.53	25,412.63	47.84	251,012.03
LEV	469	0.3348	0.3282	0.1687	0.0001	0.7701
BMV	432	0.6953	0.5314	0.5889	0.0075	4.1556

The correlation analysis of Table 6 indicates a positive relationship between WACC variables and its components CoD and CoE, as expected. The correlation is higher between WACC and CoE (0.9029), than between WACC and CoD (0.2362), since the weight of the cost of equity is higher than the cost of debt (see Table 5). In addition, there is

Magazine of Administration, Accounting Sciences and Sustainability, 13 (2), 2023.

REUNIR

177

a negative relation between overall ESG metrics and WACC (-0.1131), as well as between the social dimension (S) and WACC (-0.1389) and CoE (-0.0928). This may indicate that the costs of capital are more affected by social responsibility practices than by those of the other dimensions - environmental (E) and corporate governance (G).

Obviously, there was a high positive correlation between ESG and its individual metrics (E, S, and G). However, it is interesting to note that: i) dimensions E (0.9126) and S (0.8799) showed a higher correlation with the overall ESG score than G (0.5786); and ii) there was a higher correlation between E and S (0.6472) than between E and G (0.3569). As for the control variables, there was a positive relationship between firm size (SIZ) and the overall and individual ESG metrics. In addition, larger firms are more

leveraged (0.1041) and have higher market value (-0.1044).

The negative correlation (-0.1389) between BMV and overall ESG score shows that companies that adopt sustainability practices have higher market value. In addition, BMV shows a positive correlation with WACC (0.1431) and CoE (0.1515), suggesting that these costs follow company valuation. As for leverage (LEV), there is a negative correlation with CoD (-0.2954) and WACC (-0.2961), pointing to the effect of the tax benefit of debt, already predicted in the analysis in Table 5. In contrast, LEV shows a positive correlation with the overall ESG score (0.1536) and its dimensions E (0.1256) and S (0.1692), indicating that debts may be a priority source of funding for ESG practices.

Table 6
Correlation analysis

	WACC	CoE	CoD	ESG	E	S	G	SIZ	LEV	BMV
WACC	1.00									
CoE	0.90	1.00								
	0.00									
CoD	0.24	0.06	1.00							
	0.00	0.23								
ESG	-0.11	-0.07	-0.04	1.00						
	0.02	0.14	0.43							
E	-0.06	-0.04	-0.02	0.91	1.00					
	0.24	0.47	0.74	0.00						
S	-0.14	-0.09	-0.06	0.88	0.65	1.00				
	0.00	0.05	0.17	0.00	0.00					
G	-0.03	-0.03	0.01	0.58	0.36	0.41	1.00			
	0.60	0.54	0.85	0.00	0.00	0.00				
SIZ	-0.04	0.04	0.03	0.48	0.47	0.37	0.21	1.00		
	0.36	0.42	0.49	0.00	0.00	0.00	0.00			
LEV	-0.30	-0.06	-0.30	0.15	0.13	0.17	-0.02	0.10	1.00	
	0.00	0.18	0.00	0.00	0.00	0.00	0.74	0.02		
BMV	0.14	0.15	-0.03	-0.14	-0.08	-0.15	-0.10	-0.10	-0.10	1.00
	0.00	0.00	0.55	0.00	0.13	0.00	0.03	0.03	0.03	

Note: The upper values refer to Pearson's coefficient, while the lower values refer to the statistical significance level of the correlation

Table 7 presents the results of the regression models of Equation 1. In models 1-

2 WACC is the dependent variable. The dependent variables for models 3-4 and 5-6 are cost of equity (CoE) and cost of debt (CoD), respectively. The independent variable for models 1, 3, and 5 is the overall ESG score. The independent variables of models 2, 4, and 6 are the individual scores of each of its dimensions (E, S, and G). As mentioned in item 3 - Methodology, data from models 1 to 4 are regressed pooled, while data from models 5 and 6 are regressed in panel with fixed effects.

As for the result of the assumption tests of models 1 and 2 (WACC), we found that: i) there is at least one non-zero angular coefficient. Therefore, the model is valid and linear (Prob > F = 0.0000); ii) the heteroscedasticity of the model is corrected through robust standard errors – vce (robust); and iii) the explanatory variables do not have a variance inflation factor (VIF) higher than 3, thus characterizing the absence of high multicollinearity between them.

For models 3 and 4 (CoE), all angular coefficients of the explanatory variables are statistically equal to zero. Therefore, the model is not statistically significant. Regarding models 5 and 6 with panel data (CoD), the assumption tests indicate that the residues are: i) fixed, according to Hausman's test; ii) heteroscedastic, being corrected through robust standard errors - fe robust; and iii) not self-correlated. In addition, there is at least one non-zero angular coefficient. Thus, the model is valid and linear (Prob > F = 0.0000).

Regarding the models' explanatory power, we observed that models 1 and 5, with overall ESG scores, have higher explanatory power (R^2) than models 2 and 6, with individual scores. This may stem from the fact that the overall ESG metric can capture the synergy of the 3 dimensions, surpassing the sum of the individual scores. As for the number of observations, there is a difference

from what is presented in Table 5. When running the econometric models, Stata software only considers observations of dependent variables whose explanatory variable data are complete – without missing values.

About the results of the regressions, models 1 and 2 present statistical significance only for the angular coefficient of the control variable leverage (LEV) - at 1% level. In the case of model 1, for each 1% increase in the company's degree of indebtedness, there is a 0.1170% reduction in WACC. This fact confirms the trade-off theory, according to which debt capital has the benefit of tax deduction (Kraus & Litzenberger, 1973).

Sharfman and Fernando (2008), Zainon *et al.* (2020) and Gholami *et al.* (2022) identified this same relationship. Investors and analysts consider the improvement in environmental risk factors when making investment decisions and recommendations. This makes the financial market willing to allow the company to practice higher levels of leverage, which may result in a general reduction of the cost of capital.

Models 5 and 6 also show a negative relationship between LEV and the dependent variable - CoD. However, this result is opposite to those of Gerwanski (2020), Eliwa *et al.* (2021) and Raimo *et al.* (2021a). Although they have identified a positive relationship, they observe that more leveraged firms are more likely to release integrated reports with high information connectivity. This facilitates credit risk analysis and lowers debt capital costs.

In the case of model 6, in 2020, the year of highest impact of Covid-19, companies' CoD decreased by 1.84%. This is mainly due to the drop in Brazil's risk-free interest rate (Selic), from 4.25% p.a. in January to 2.00% p.a. in December (Banco Central do Brasil, 2022). Still on model 6, for every 1 score increase in the environmental dimension (E),

REUNIR

there is a 0.0008% reduction in CoD. This fact confirms H_1 - *The higher the ESG score, the lower the companies' cost of capital*. This result confirms Houqe *et al.* (2020). According to the authors, the disclosure of ESG information in companies' financial statements can reduce agency costs and information asymmetry, thus, companies' cost of capital.

The non-statistical significance of models 3 and 4 (CoE) implies that sustainability practices, in Brazil, do not have the same impact on the cost of equity, when compared to the cost of debt (CoD) and to the weighted average (WACC). Specifically for model 3, this result contradicts those obtained by

Hmaittane *et al.* (2019), Jiménez & Zorio-Grima (2021), Raimo *et al.* (2021b) and Yu *et al.* (2021) (see Table 2).

Furthermore, the non-statistical significance of the angular coefficients of the overall and individual ESG scores, in the other models, indicates that the Brazilian market is at a stage of evolution regarding sustainability practices. Unlike developed countries, companies and investors are still unable to perceive the benefits of such policies for mitigating risks, thus reducing the cost of capital and its components.

Table 7
Regression results

Dependent variable	WACC		CoE		CoD	
Model	1	2	3	4	5	6
# obs	415	387	414	386	421	394
Prob > F	0.0000	0.0000	0.0947	0.1999	0.0004	0.0033
R-sq	0.1176	0.1150	0.0319	0.0406	0.1034	0.0853
ESG	-0.0004	n/a	-0.0007	n/a	-0.0007	n/a
E	n/a	0.0000	n/a	-0.0002	n/a	-0.0008**
S	n/a	-0.0002	n/a	-0.0002	n/a	0.0005
G	n/a	-0.0003	n/a	-0.0007	n/a	0.0003
SIZ	0.0003	0.0014	0.0051	0.0070	0.0122	-0.0015
LEV	-0.1170***	-0.1053***	-0.0358	-0.0240	-0.2989*	-0.3199*
BMV	0.0117	0.0147	0.0241	0.0283	-0.0014	-0.0036
COV	-0.0086*	-0.0063	0.0056	0.0085	-0.0014***	-0.0184***
const	0.1437***	0.1402***	0.1135***	0.1161**	0.0948	0.17633

Notes: Statistically significant coefficients at 1% (***), 5% (**), and 10% (*) levels

Final remarks

Recognizing the need for actions to face the impacts of climate change, diversity, and compliance rules causes an increase of companies' investments in sustainability practices. Besides adding value, these companies are interested in analyzing the effect of their policies on market's perception of risk mitigation, expressed in a potential decrease of their cost of capital.

Hence, this study sought to confirm hypothesis H_1- *The higher the ESG score, the lower the companies' cost of capital.* The cost of capital was broken down into its own (CoE) and debt (CoD) components, being further checked by its weighted average (WACC). ESG is also analyzed through its consolidated metric, and separated into its 3 dimensions. To do that, we analyzed a final sample of 96 Brazilian non-financial companies, with data for the period 2016-2020. Data were obtained from Bloomberg, Capital IQ Pro, by Standard

& Poor's, and Federal Reserve Economic Data, and examined through descriptive analysis, correlation, and linear regression - pooled and panel.

The econometric regressions confirmed H_1 only for model 6 in Table 7. We found a negative relation between the environmental component (E) and the cost of debt capital (CoD), statistically significant at 5% level.

Still on model 6 in Table 7, it is important to highlight that, in 2020, there was a reduction in companies' CoD of 1.84%. This is mainly due to the drop of the Selic rate, from 4.25% to 2% p.a., from August 5, 2020 (Banco Central do Brasil, 2022). The practical interpretation of the -0.0008 coefficient, statistically significant at 5% level, is that for every 1 score increase in the environmental dimension (E), there is a 0.0008% reduction in CoD.

In fact, there is a growing concern of the countries about environmental issues. Brazil stands out even more due to the diversity of biomes that exist throughout its territory, and the need to exploit them sustainably. This result agrees with Houqe *et al.* (2020), reflecting the reduction of information asymmetry and agency conflict between managers and owners.

The non-ratification of H1 by the other models - 1 to 5 in Table 7 - indicates that creditors are more sensitive to the environmental practices of companies than shareholders. Furthermore, the Brazilian market is still in an evolutionary process with regard to perceiving the financial benefits of adopting sustainability practices. Unlike developed countries, companies and investors are still unable to notice the benefits of such policies in mitigating risks, and the consequent reduction of the cost of capital and its components. On the other hand, this fact shows opportunities for continuing such investments with subsequent return.

Among the contributions of this study is the analysis of the impact of non-financial information, such as ESG scores, on organizations' cost of capital. The emphasis on the environmental dimension shows relevant guidelines for their investment decisions in sustainable practices. Furthermore, we highlight the analysis of this effect at a pandemic moment, providing valuable information for defining government's future monetary policies, in scenarios of similar uncertainties. Finally, the results of this research are relevant to capital market participants, allowing them a better understanding of the implications of the involvement of Brazilian companies in environmentally and socially conscious activities.

Among the limitations of this study is not considering privately held companies, such as startups. Such companies are funded by venture capitalists, who are more aligned with sustainability issues, especially those in developed markets.

For the continuation of this research, we suggest investigating this topic in other emerging countries. Other aspects to address are the analysis of the metrics of the score components of each ESG dimension, as well as the use of other models to calculate the cost of equity (CoE), such as the Fama-French three-factor and the price arbitrage (APM).

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183

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184

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186