Environmental, social and governance (ESG) and systematic risk: The moderating effect of environmental innovation and analyst coverage

1 Introduction

Companies are under increasing pressure to improve their sustainability performance and meet the needs of their stakeholders (Kalash, 2021). ESG relates to the integration of environmental, social, and governance issues by companies and investors into their business models (Gillan et al., 2021). ESG performance takes into account environmental, social and governance aspects of the company and the ESG score assesses whether a company is socially and environmentally responsible in society (Shakil, 2021). In this line, ESG performance is a powerful instrument used to prevent damage to the company, reducing the risk of financial crisis and litigation (Reber et al., 2021) and ESG aspects are crucial to the fulfillment of corporate social responsibility (Qoyum et al., 2021). Integrating ESG aspects into business decision making helps investors make decisions aimed at overall performance, not just financial performance (Mohammad & Wasiuzzaman, 2021).

Risk began to attract interest in the economic literature, when a basic distinction between risk and uncertainty was made; risk, as opposed to uncertainty, relates to events that are predictable in some way and are statistically calculable (Karwowski & Raulinajtys-Grzybek, 2021) and the ability of managers to deal with company risk is crucial to survival and business performance (Zou et al., 2020). In this context, risk can be considered a probability that an action or inaction will lead to loss with all human efforts presenting some degree of risk, and in the financial literature, risk can be defined as unexpected events that lead to changes in the values of the company's debts or assets (Salehi et al., 2020) and there are two types of risks: unsystematic (which are the company-specific risks that can be eliminated by diversification) and systematic (which are the market risks) (Brealey & Myers, 2000).

Increasingly, institutional investors and stock analysts are attracted to eco-innovative companies (Zaman et al., 2021). Environmental innovation is embedded in the business strategy, impacting production processes and products (García-Sánchez, Gallego-Álvarez, et al., 2021). Environmental innovation can be developed by companies or non-profit organizations, can be of a social, technological, institutional or organizational nature, and may or may not be commercialized in the market (Rennings, 2000). Scholars have found that environmental innovation is associated with a range of benefits, including reduced CO2 emissions (Cheng et al., 2021; Töbelmann & Wendler, 2020), reduced stock price crash risk (Zaman et al., 2021) superior economic performance (Aastvedt et al., 2021; Andries & Stephan, 2019; Liao, 2018; Long et al., 2017). Furthermore, environmental innovation enables the efficient use of resources, employing environmental cost reduction techniques leading to the invention of cleaner technologies (Cheng et al., 2021)

Information plays a key role in the functioning of the stock market; stock prices are correctly priced when the relevant information is incorporated into the price and financial analysts play a crucial role in this process by bringing new information about companies (Farooq & Satt, 2014). In this context, valuable information is crucial for investors in this time of information explosion (Wang et al., 2020). Analyst monitored performance motivates managers to strive to make decisions that create value for shareholders (Shiah-Hou, 2016). Analysts can be considered a bridge between companies and investors (Wang et al., 2020) and companies that are followed by a large number of analysts have greater monitoring (García-Sánchez et al., 2020).

Prior literature has examined the effect of engaging in social and environmental activities on firm risk. Overall, studies document a negative effect of engaging in social and environmental activities on systematic firm risk (Albuquerque et al., 2019; Hassan et al., 2021; Rehman et al., 2020; Zou et al., 2020). Similarly, environmental innovation positively

influences financial performance (Aastvedt et al., 2021; Long et al., 2017) and negatively influences CO2 emissions (Cheng et al., 2021; Töbelmann & Wendler, 2020), however, there are no studies that address the moderating role of environmental innovation in the relationship between ESG performance and systematic risk. Studies have also found that analyst coverage is positively related to CSR (Chun & Shin, 2018; Dhaliwal et al., 2012; Jo & Harjoto, 2014) and external assurance (García-Sánchez, Hussain, et al., 2021), in addition, it reduces CSR decoupling (García-Sánchez et al., 2020) and the devaluation of equity (Li, 2020), however, there are no studies that address the moderating role of analyst coverage on the relationship between ESG performance and systematic risk. Therefore, to the best of our knowledge, this is the first paper to address the impact of ESG performance on firm systematic risk and analyze the moderating role of environmental innovation and analyst coverage in this association.

This paper seeks to answer three research questions with the aim of filling a gap in the literature and providing theoretical and empirical evidence to contribute to the ESG issues and systematic risk literature. The research questions are as follows - (1) Is there any influence of ESG on firms' systematic risk? (2) Does environmental innovation moderate ESG-systematic risk nexus? and (3) Does analyst coverage moderate the association between ESG and systematic risk? Theoretically, the effect of ESG issues on systematic risk can be explained using stakeholder theory and the resource-based view. Stakeholder is a group or individual that affects or can be affected by the organization and stakeholder theory is a set of propositions that suggests that companies have obligations to their stakeholders (Freeman, 2015). According to the resource-based view, company resources can only be a source of competitive advantage when they are valuable, rare, imperfectly imitable and substitutability (Barney, 1991). The unified approach of stakeholder theory and the resource-based view can explain why a firm exists (Freeman et al., 2021).

The study has several contributions. First, most CSR studies occur in developed countries and focus only on analyzing firms in a particular country, in that the factors that lead a firm to undertake ESG activities in developed and emerging economy countries are different (Aqif & Wahab, 2021), Thus, the study contributes by examining the systematic risk nexus of ESG in emerging countries. Second, the study contributes by using quantile regression on the ESG-systematic risk nexus. quantile regression examines the effect of predictors on the quartiles of the dependent variable, providing a more complete view than average regression on possible causal relationships between the dependent variable and explanatory variables (Liang et al., 2021). Third, the study extends the literature by quantitatively examining the influence of ESG on systematic risk and the moderating role of environmental innovation and analyst coverage in this relationship. Finally, COVID-19 pushed companies to seek better environmental and social behaviors (Popkova et al., 2021), the study contributes by assisting managers on environmental and social issues in the post-pandemic world.

The rest of the paper is organized as follows. Section 2 discusses the relevant literature and presents the hypotheses. Section 3 describes the sample, the data and the methodology. Section 4 presents and discusses the results, and section 5 concludes the study.

2 Literature review and hypothesis development

2.1 Environmental, social and governance and systematic risk

Firm risk can be viewed as the fluctuations in the firm's performance over time (Zou et al., 2020). The risks are classified into systematic risk (general market risks) and non-systematic or idiosyncratic risk (risk related to a specific company) (Lueg et al., 2019). Systematic risk is related to the entire market, occurring through general market movements, affecting the total price of the securities that are made available in the financial market (Salehi et al., 2020) and systematic risks are difficult to protect against or eliminate completely, but can be managed or

minimized, because they are risks associated with political, economic, and social events (Garcia et al., 2017). Thus, systematic risk is more associated with industry-specific characteristics and unsystematic risk (idiosyncratic risk) is associated with company-specific characteristics (Shakil, 2021).

Currently over 3000 institutional investors and service providers have signed the Principles of Responsible Investment (PRI), an agreement to incorporate ESG aspects into their decision-making and investments (Gillan et al., 2021) and socially responsible companies have higher customer loyalty and higher investor preference, and are less price sensitive; this makes the shares of socially responsible companies more resilient to market shocks and less exposed to risk (Salehi et al., 2020). Environmental and social performance helps companies to be socially responsible to all their stakeholders (Ullah & Nasim, 2021). Social performance can be considered a risk management mechanism with investors considering the commitment to environmental and social issues as a sign of lower risk for the company (Kalash, 2021). In this line, involvement in social and environmental activities leads to an improvement in the organization's image, helping to reduce financial risk and improving credit ratings, as well as lowering the cost of capital (Rehman et al., 2020). Companies with good environmental and social performance have stakeholders less likely to impose sanctions after negative events (Hassan et al., 2021) and investors penalize companies that have poor ESG performance (Shakil, 2021). Engaging in social and environmental activities contributes to a sustainable competitive advantage by mitigating the risks of additional costs (Gangi et al., 2020). Thus, investment in social and environmental activities can increase the corporate profitability and reduce firm risk (Xue et al., 2020).

According to stakeholder theory, carefully managed and trusted stakeholder relationships are difficult to imitate and valuable, being a source of competitive advantage (Freeman et al., 2021). Stakeholder theory asserts that involvement in environmental activities can improve relationships with stakeholders, benefiting the company in the long run and consequently reducing financial risk (Xue et al., 2020). Companies with higher ESG performance have greater legitimacy with their external stakeholders, decreasing the risk of negative company incidents (Reber et al., 2021) and negligence regarding ESG can cause the company to suffer reputational damage in the financial markets, causing stock volatility (Shakil, 2021). According to stakeholder theory, protecting the environment is beneficial for the company as a whole (Djoutsa Wamba et al., 2020). Furthermore, engaging in social and environmental activities can be useful when the company needs the support of its stakeholders and reduces financial risk by improving credit ratings and thus reducing the cost of capital (Rehman et al., 2020).

Resource is anything that can be seen as a strength or weakness of a firm (Wernerfelt, 1984). In this line, firms can structure their resources aiming at building organizational capacity to gain competitive advantage and one of these resources is corporate social responsibility (Ho et al., 2021). According to the resource-based view, the difference in the firm's performance are mainly the result of the existing heterogeneity of resources (Christmann, 2000) and a good reputation provides firms with more stable resources on more favorable terms, leading to a decrease in financial risk (Brahmana et al., 2020) and ESG performance can be a measure of the firm's intangible resources being seen as a form of respect and reputation, so investing in ESG aspects can be the same as investing in the firm's reputation (Sharma et al., 2019).

Albuquerque et al., (2019) examined the relationship between CSR and firms' systematic risk from a sample of 28578 annual observations of United States companies over the period 2003-2015. The authors found that the level of systematic risk is lower for companies with better CSR performance. Similarly, Shakil (2021) analyzed the relationship between ESG performance and company financial risk in 70 oil and gas companies over the period 2010-2018 and concluded that ESG performance has a negative relationship with total risk and a non-

significant relationship with systematic risk. Rehman et al., (2020) took a stakeholder theory approach and analyzed the impact of corporate responsibility on firm performance and firm risk using a sample of 1193 companies during the period 2014-2018 collected from MSCI's ESG database and Fortune's Global 500 database and found a positive relationship between corporate social responsibility and financial performance and that corporate social responsibility negatively influences firms' systematic risk.

Following the stakeholder theory, Hassan et al., (2021) analyzed the relationship between ESG scores and firm risk from 4624 non-financial firms from Africa, Asia, Europe, Latin America, North America, and Oceania over the period 2002-2018 collected from the Thomson Reuters database and found that ESG score reduces firms' systematic risk for all firms. Mohanty et al., (2021) used MSCI All Country World Index data over the period December 2007 to August 2020 and found that companies that follow stricter ESG principles are more resilient to systematic market shocks. Zou et al., (2020) indicated a negative relationship between corporate social responsibility and firm risk, from a sample of 6720 firm year observations of Chinese firms over the period 2009-2014. Based on the theoretical framework and the relationships found in previous studies, we propose the following hypotheses:

Hypothesis 1: ESG performance is negatively related to systematic risk

2.2 The moderating effect of environmental innovation on the relationship between ESG performance and systematic risk

Eco-innovative companies have more transparency and are less likely to withhold bad news, carrying a lower risk of falling share prices (Zaman et al., 2021). Moreover, environmental innovation can also be associated with greenhouse gas emission reductions and environmental relief (Töbelmann & Wendler, 2020). Environmental innovation improves the efficiency of the production process by reducing resource consumption (García-Sánchez, Gallego-Álvarez, et al., 2021). (Rennings, 2000) addresses that environmental innovation needs specific legislation to be implemented, because technological and market push factors alone do not seem to be strong enough. Moreover, environmental innovation can also be seen as an important means of gaining competitive advantage (Liao, 2018)

Resource-based view asserts that companies must develop internal capabilities to gain competitive advantage (Barney, 1991). Firms are made up of resources that can be a source of competitive advantage, because the fact that a firm owns a resource adversely affects the costs of subsequent acquirers (Wernerfelt, 1984). According to the resource-based view there is a relationship between company resources and the ability of companies to manage environmental innovation projects (Portillo-Tarragona et al., 2018) and the adoption of environmental innovation can promote financial benefits for the firm, because environmental innovation can generate cost reduction in the production process and the technology used in environmental innovation processes, such as internal innovation of pollution prevention technologies can be a source of competitive advantage (Christmann, 2000).

According to stakeholder theory, building and maintaining sustainable relationships with your stakeholders is crucial to firm performance (Freeman et al., 2021). Stakeholder theory covers the ethical, moral, and social values in the company's management of environmental and social activities and companies have internal stakeholders (employees, managers, and shareholders) and external stakeholders (suppliers, customers, creditors, and government) (Shakil, 2021). Stakeholder theory takes a holistic view of the company's objectives, proposing an accountability of the company's activities to its internal and external stakeholders (Ullah & Nasim, 2021). According to stakeholder theory, in the context of environmental innovation, a firm's good relationship with its stakeholders can lead to better financial performance, with this, firms proactively engage in environmental innovation to satisfy their stakeholders and increase their financial performance (Andries & Stephan, 2019).

Cheng et al., 2021) found a negative relationship between environmental innovation and CO_2 emissions. Similarly, Töbelmann and Wendler (2020) examined the relationship between environmental innovation and carbon dioxide emissions in 27 European Union countries over the period 1992-2014 and found that environmental innovation contributes to reduced carbon dioxide emissions. Zaman et al., (2021) found a negative relationship between eco-innovation and stock price crash risk. Aastvedt et al., (2021) used a 44 sample of US and European oil and gas companies over the period 2010-2018 and found that environmental innovation has a positive effect on financial performance. Similarly, Andries and Stephan (2019) based on the resource-based view and stakeholder theory and found that environmental innovation relates positively to financial performance. Long et al., (2017) revealed that environmental innovation has a statistically positive effect of 0.781 and 0.549 on environmental performance and economic performance, respectively. Thus, in line with stakeholder theory and resource-based view and prior empirical findings, the following hypothesis is proposed:

Hypothesis 2: Environmental innovation has a negative moderating effect on the relationship between ESG and systematic risk

2.3 The moderating effect of analyst coverage on the relationship between ESG performance and systematic risk

Analyst coverage acts as an information bridge between the external and internal parts of the company (Naqvi et al., 2021). Analysts interact with managers during the release of the results and express their opinions through research reports or through the media, as when they appear in television interviews (Chun & Shin, 2018) and analysts can be considered an alternative to the firms' external governance mechanisms (Shiah-Hou, 2016). In this line, increased analyst coverage reduces informational asymmetry, giving investors more accurate information, decreasing equity devaluation (Li, 2020), financial analysts influence investors' decisions by being active participants in the disclosure of information (Li, 2020) and more analysts can provide more information to investors and improve firm value (García-Sánchez et al., 2020).

Analyst investment recommendations published as buy, sell or hold recommendations are useful advice to investors (García-Sánchez et al., 2020). Greater analyst coverage causes companies to become more involved in social and environmental activities, increasing their reputation in the public eye (Chun & Shin, 2018). Companies with greater analyst coverage often receive greater attention from society and are more likely to be evaluated positively by stakeholders by achieving good environmental and social performance (Chun & Shin, 2018). Analysts are information intermediaries, who evaluate the credibility of information (Lu & Abeysekera, 2021). Thus, analysts can help companies realize the economic benefits of adopting ethical business conduct (García-Sánchez et al., 2020).

García-Sánchez et al., (2020) from a sample of 7681 annual observations for the period 2006-2015 found that higher analyst coverage, reduces CSR decoupling. Dhaliwal et al., (2012) based on stakeholder theory and found analyst accuracy to be positively associated with CSR. Jo and Harjoto (2014) examined the relationship between analyst coverage, CSR and firm risk from a sample of 14482 annual observations (3079 firms), the results showed that increasing analyst coverage reduces firm risk (except for CSR strengths) and that analyst coverage is positively associated with CSR. García-Sánchez, Hussain, et al., (2021) used a sample of 10819 observations from 1588 companies located in 59 countries for the period 2009-2017 and found that analyst coverage positively impacts companies' decision to purchase external assurance, increasing the credibility and reliability of environmental and social performance information. Chun and Shin (2018) analyzed the association between analyst coverage and corporate social performance, from 3146 annual observations of Korean companies over the period 2002-2015 and found that analyst coverage positively influences corporate social performance.

Farooq and Satt (2014) examined the association between governance mechanisms and firm performance from a sample of companies in Morocco, Egypt, Saudi Arabia, United Arab Emirates, Jordan, Kuwait, and Bahrain and found that analyst coverage positively influences firm performance. Mouselli and Hussainey (2014) found that analyst coverage has no significant effect on firm value. Yang et al., (2020) used a 20650 sample of annual observations from 2009 to 2017 and found that companies with analyst coverage are less likely to engage in corporate misconduct, reduce informational asymmetry, and provide quality information. Li, (2020) found that analyst coverage negatively influences the devaluation of equity. Therefore, Thus, in line with prior empirical findings, the following hypothesis is proposed:

Hypothesis 3: Analyst coverage has a negative moderating effect on the relationship between ESG and systematic risk

3 Data and methodology

3.1 Sample selection

To test the hypotheses, we use a sample consisting of 6371 firms-year observation of 2079 firms from Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Kuwait, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, Saudi Arabia, South Africa, Taiwan, Thailand, Turkey and United Arab Emirates in the period 2015-2020. These countries were selected because they belong to the Morgan Stanley Capital International (MSCI) Emerging Markets Index, which captures large and mid-cap representation in 27 Emerging Market countries, the index has 1407 constituents and covers approximately 85% of the free float-adjusted market capitalization in each country (MSCI, 2021). Our data set is made up of information from the Refinitiv database, which has the most comprehensive ESG database in the industry, covering more than 70% of the global market, with more than 500 different ESG metrics (Refinitiv, 2021). Table 1 presents the composition of the sample studied by sector, based on the Global Industry Classification Standard (GICS) and country.

Table 1

Sample composition by industry and country

Panel A – Composition by industry

Industry	Observations	%	Industry	Observations	%
Communication Services	472	7.42	Industrials	1123	17.65
Consumer Discretionary	808	12.70	Information Technology	641	10.08
Consumer Staples	658	10.34	Materials	899	14.13
Energy	370	5.82	Real State	394	6.19
Financials	167	2.62	Utilities	449	7.06
Health Care	381	5.99			

Panel B – Composition by country

Country	Observations	%	Country	Observations	%
Argentina	148	2.32	Mexico	193	3.03
Brazil	424	6.66	Pakistan	6	0.09
Chile	161	2.53	Peru	107	1.68
China	1686	26.46	Philippines	107	1.68
Colombia	57	0.89	Poland	116	1.82
Czech Republic	10	0.16	Qatar	33	0.52
Egypt	34	0.53	Russia	171	2.68
Greece	83	1.30	Saudi Arabia	69	1.08
Hungary	17	0.27	South Africa	479	7.52
India	451	7.08	Taiwan	598	9.39
Indonesia	181	2.84	Thailand	218	3.42
Korea Republic	560	8.79	Turkey	152	2.39

Kuwait	25	0.39	United Arab Emirates	42	0.66
Malaysia	243	3.81			

The results in Table 1 indicate that the sample is divided into 11 sectors (Panel A) and 27 countries (Panel B). The most representative sector in the sample is Industrials with 1123 observations (17.65%), followed by Materials (14.13%) and Consumer Staples (10.34%). In terms of countries, the most represented are China, Taiwan, Korea Republic and South Africa with 1686 (26.46%), 598 (9.39%), 560 (8.79%) and 479 (7.52%), respectively.

3.2 Variables

3.2.1 Dependent variable

This study employs a firm systematic risk measure (beta index) as the dependent variable of the research. Beta index is estimated by CAPM beta and is calculated by the covariance of the security's price movement relative to the market price movement. Based on data availability, various look back periods can be used to calculate it and are used in the calculation Beta 5Y monthly, Beta 3Y weekly, Beta 2Y weekly, Beta 180D daily, Beta 90D, in order of preference. Beta index measures systematic risk because it measures the compliance of the movement of a company and the entire market (Salehi et al., 2020), i.e., lower beta represents lower systematic risk, with investors presenting lower return than the return expected by the market (Mohanty et al., 2021) and systematic risk is applied to all companies in a given industry (Lueg et al., 2019).

3.2.2 Independent variables and moderating variables

Our independent variable is ESG score. ESG score is an overall company score based on the self-reported information in the environmental, social and corporate governance pillars (Refinitiv, 2021) and is based on reported information from the environmental, social, and governance pillars, and is an overall company score ranging from 0 to 100 (Barros et al., 2021). See the variables description in Table 2.

Table 2

Variables description

Variable name	Variable name	Model name	Proxy
Dependent	Beta index	BETA	Covariance of the security's price movement relative to the market price movement.
Independent	ESG score	ESG	Environmental, Social and Governance score, which ranges from 0 to 100, based on the Environmental, Social and Governance performance of the firm.
Moderator	Environmental innovation score	EINOV	Environmental innovation score, which ranges from 0 to 100, based on the environmental innovation performance of the firm.
Moderator	Analyst coverage	ANCOV	Total number of analysts covering a company in a given year
Control	Board size	BSIZE	Total number of directors in a company's board
Control	Profitability	ROA	Earnings before interest, tax, depreciation, and amortization (EBITDA)/Total assets.
Control	Leverage	LEV	Total debt/Total assets
Control	Firm size	FSIZE	Natural logarithm of total assets

Two moderating variables, namely environmental innovation score and analyst coverage were used in the present study. Environmental innovation score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or eco-designed products (Refinitiv, 2021) and environmental innovation score is adjusted from the industry

weighted average on a scale of 0-100, covering twenty variables related to organizational environmental innovation and eco-processes, where 100 reflects a high level of company commitment to environmental innovation (Zaman et al., 2021). The analyst coverage variable is measured by the total number of analysts covering a company in a given year (Farooq et al., 2021; Martins & de Campos Barros, 2021).

3.2.3 Control variables

We include control variables at the board and company level that can affect the firm systematic risk. At the board level, we included board size which is the total number of directors in a company's board. Companies with a larger board of directors present a lower systematic risk during crisis periods (Chintrakarn et al., 2021) and are more likely to have individuals who monitor the behavior of managers effectively (Baulkaran & Bhattarai, 2020). At the firm level, profitability is included as a control variable. Profitability is the return on assets ratio (ROA), computed as Earnings before interest, tax, depreciation, and amortization (EBITDA) divided by total assets. Companies with better financial performance have greater access to resources, reducing their risks (Biswas, 2021) and tend to have lower systematic risk (Maxfield & Wang, 2020). We also included leverage. Leverage is measured by dividing total debt over total assets and a higher percentage of financial leverage can affect the firm risk, having a positive effect on the firm systematic risk (Shakil, 2021) and greater leverage can make directors more diligent in their duties (Baulkaran & Bhattarai, 2020). Finally, firm size is measured by the logarithm of total assets. Large companies are financially stable with resources to increase their operational efficiency (Shakil, 2021) Salehi et al., (2021) asserts that by increasing the size of the company, the company's risk decreases. All variables are measured using fiscal-year-end values and are winsorized at the 1% and 99% levels.

3.2.4 Model specification

In order to address the variability of the systematic risk-environmental innovation nexus, we employ quantile regression. Quantile regression is able to detect more effects than conventional procedures, and does not restrict the conditional mean, thus allowing you to approximate the entire conditional distribution of the response variable (Davino et al., 2013) and in quantile regression, "the quantiles of the conditional distribution of the response variable are expressed as functions of observed covariates" (Koenker & Hallock, 2001). Quantile regression is an extension of classical regression that provides information about the entire conditional distribution of the response variable (Kim et al., 2020). Quantile regression is an improvement on conditional mean regression and estimates in quartiles (for example, 25%, 50%, and 75%) that the estimation is unable to reach (Oware & Mallikarjunappa, 2021). Thus, in order to verify the influence of ESG performance on systematic risk and the moderating effect of environmental innovation score and analyst coverage, the following model is estimated:

$$Q_\tau (Risk_i|\alpha_i, \varepsilon_{it}, x_{it}) = \alpha_\tau + \beta_{1\tau} ESG + \beta_{2\tau} EINOV + \beta_{3\tau} ANCOV + + \beta_{4\tau} ESG * EINOV + \beta_{5\tau} ESG * ANCOV + \beta_{6\tau} BSIZE + \beta_{7\tau} ROA + \beta_{8\tau} LEV + \beta_9 FSIZE + \varepsilon_{it} \quad (1)$$

Where, Q_τ is the conditional quantile of τ (Koenker & Bassett Jr, 1978) and the value of τ varies between 0 and 1. $\alpha(\tau)$ is related by the unobserved effect in the quantile model (Sardaro et al., 2021). β_τ is coefficient estimates corresponding to each quantile. We assign the values 0.10, 0.25, 0.5, 0.75, and 0.90 to the quartiles of τ. ESG is the ESG score. EINOV is the environmental innovation score. ANCOV is the analyst coverage. BSIZE is the board size. ROA is the profitability. LEV is the leverage. FSIZE is the firm size.

4 Results and discussion

4.1 Descriptive statics

Table 3 provides descriptive statistics for the variables. The average beta index is 1.010, similar to the studies (Farah et al., 2021; Shakil, 2021), which have values of 0.978 and 1.215, respectively. The maximum value of the beta index is 2.499 and the minimum value is -0.074. The higher the beta index, the higher the systematic risk.

Table 3

Descriptive statics

Variables	N	Mean	SD	Minimum	Maximum
BETA	6282	1.010	0.503	-0.074	2.499
ESG	6371	41.95	20.86	2.685	86.29
EINOV	6369	21.37	28.89	0	95.16
ANCOV	6371	11.31	9.522	0	41
BSIZE	6363	9.798	3.047	4	19
ROA	6371	0.247	0.292	-0.365	1.563
LEV	6371	1.069	1.462	0	9.484
FSIZE	6371	21.09	1.442	17.38	24.91

ESG score has an average of 41.95, which is similar to the studies of (Shakil, 2021) (49.45) and (Chiaramonte et al., 2021) (59.90). The mean for the environmental innovation score is 21.37, which is lower than the findings of previous studies (de Lucia et al., 2020; Burkhardt et al., 2020) , which found 61 and 67.782, respectively. The results can be explained by the reason that the previous studies analyzed companies from Europe (de Lucia et al., 2020) and France (Burkhardt et al., 2020). All continuous variables are winsorized at the 1st and 99th percentiles.

4.2 Correlation matrix

Table 4 presents the correlation matrix. We use the correlation matrix in our study in order to measure the strength and direction of the linear relationship between our dependent variable and the independent, moderator, and control variables. The highest reported Variance Inflation Factor (VIF) is 1.43 for the ROA variable and the lowest is 1.06 for board size. Beta index has a significantly positive correlation with environmental innovation and firm size and a significantly negative correlation with ESG, board size, ROA and leverage.

Table 4

Correlation matrix and variance inflation factor (VIF)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	VIF
(1) BETA	1.000								
(2) EINOV	0.034*	1.000							1.30
(3) ESG	-0.034*	0.461*	1.000						1.41
(4) ANCOV	0.051	0.169*	0.280*	1.000					1.28
(5) BSIZE	-0.419*	0.107*	0.193*	0.058*	1.000				1.06
(6) ROA	-0.250*	-0.036*	0.096*	0.0406*	0.067*	1.000			1.43
(7) LEV	-0.048*	0.004	0.041*	-0.117*	0.093*	0.463*	1.000		1.32
(8) FSIZE	0.213*	0.222*	0.248*	0.386*	0.131*	-0.272*	-0.191*	1.000	1.39

* Symbolizes significance at 5%, respectively.

4.3 Quantile regression

Tests were performed to verify underlying assumptions of regression (collinearity, normality, and heteroscedasticity). VIF test was performed to verify the collinearity problem, the results showed were below 10, indicating absence of multicollinearity. Shapiro-Francia test was performed to check the normality of the residuals and the results rejected the null

hypothesis (p<0.000), detecting the non-normality of the residuals. To verify the heteroscedasticity problem, Breusch-Pagan test was reality and the results found indicate the rejection of the null hypothesis (13.55; p<0.000) and this suggests the presence of heteroscedasticity. Quantile regression is robust to normality, heteroscedasticity and outliers (Xiao et al., 2019). We apply quantile regression tests at the 0.25, 0.50, 0.75 and 0.99 percentiles of the dataset based on our focused variables.

Table 5 shows the results of the quantile regression. Hypothesis 1 states that ESG has negative relationship with systematic risk. Table 5 suggests that ESG has a negative effect on systematic risk at all five quantiles (0.10, 0.25, 0.50, 0.75, and 0.90), supporting Hypothesis 1. The results meet stakeholder theory, confirming that engaging in environmental, social, and governance activities improves stakeholder relationships, reducing systematic risk, and that higher ESG performance increases firm legitimacy, decreasing systematic risk. The results also meet the resource-based view, reiterating that ESG performance can be seen as a measure of intangible resources, with ESG investment being a form of investment in the company's reputation, which decreases its systematic risk. The results are in line with (Albuquerque et al., 2019; Hassan et al., 2021; Rehman et al., 2020; Zou et al., 2020), indicating a significant adverse outcome of ESG on systematic risk. The results can be explained, because companies with higher ESG performance may have a greater competitive market advantage and environmental degradation may hinder economic growth, forcing companies to participate in environmental protection programs (Chen & Ma, 2021) and companies that invest in ESG issues have a greater connection with their stakeholders and increase their reputation, thus decreasing systematic risk.

Table 5
Quantile regression

	0.10	**0.25**	**0.50**	**0.75**	**0.90**
	Coef p-value	Coef p-value	Coef p-value	Coef p-value	Coef p-value
ESG	-0.01 0.045**	-0.001 0.006***	-0.001 0.010***	-0.001 0.044**	-0.002 0.073*
EINOV	0.001 0.198	0.001 0.098*	0.001 0.788	0.001 0.768	0.001 0.211
ANCOV	-0.002 0.275	0.001 0.005**	-0.04 0.002***	0.001 0.691	-0.005 0.114
ESG*EINOV	-0.001 0.114	-0.001 0.202	-0.001 0.986	0.001 0.573	-0.001 0.270
ESG*ANCOV	-0.001 0.909	0.001 0.276	0.001 0.065*	0.001 0.373	0.001 0.177
BSIZE	0.006 0.0029***	-0.001 0.423	-0.008 0.000***	-0.014 0.000***	-0.017 0.000***
ROA	-1.695 0.000***	-0.269 0.000***	-0.371 0.000***	-0.497 0.000***	-0.585 0.000***
LEV	0.019 0.003***	0.023 0.000***	0.024 0.000***	0.039 0.000***	0.038 0.001***
FSIZE	0.101 0.000***	0.086 0.000***	0.059 0.000***	0.058 0.000***	0.048 0.000***
Constant	-1.644 0.000***	-0.970 0.000***	-0.109 0.535	0.327 0.040**	-0.981 0.000***
Observations	6274	6274	6274	6274	6274
Pseudo R^2	0.0737	0.0575	0.0515	0.0584	0.0605

Note: ***p < 0.01, **p < 0.05, *p < 0.1. We assign the values 0.10, 0.25, 0.5, 0.75, and 0.90 to the quartiles of τ. ESG is the ESG score. EINOV is the environmental innovation score. ANCOV is the analyst coverage. BSIZE is the board size. ROA is the profitability. LEV is the leverage. FSIZE is the firm size. All continuous variables are winsorized at the 1st and 99th percentiles. The sample period observed is 2015–2020.

The results show that environmental innovation does not moderate the relationship between ESG and systematic risk at any of the five quantiles (0.10, 0.25, 0.50, 0.75, and 0.90), going against the idea that environmental innovation can be a source of competitive advantage (resource-based view) and that it satisfies the interests of the company's stakeholders (stakeholder theory). Thus, the results did not lend support to the acceptance of Hypothesis 2 concerning the moderating role of environmental innovation between ESG and systematic risk. The results can be explained by the fact that environmental innovation can generate additional costs for companies, especially for companies that do not have as many resources available (Liao et al., 2021), because the costs are higher in the short term (Hizarci-Payne et al., 2021), decreasing the company's profits (Rennings & Rammer, 2011). In this line, in more

environmentally innovative firms, ESG does not influence systematic risk, indicating that in environmentally innovative firms, financial performance is not influenced, in line with (Duque-Grisales et al., 2020; Weche, 2015). Weche (2015) found that higher volume in green investment decreases other business investments, indicating that environmental investments do not bring financial returns. Duque-Grisales et al., (2020) examined the effect of green innovation on the financial performance of 86 Latin American companies over the period 2013-2017. The results show there is no significant relationship between green innovation and financial performance.

Finally, the results indicate that analyst coverage only moderates the relationship between ESG and systematic risk by one quartile (0.50), i.e., in firms with higher analyst coverage ESG does not influence systematic risk, not supporting hypothesis 3. Analyst coverage is related to the number of analysts who follow a company and regularly issue publications of forecasts and recommendations (Hinze & Sump, 2019). This result can be explained, because a higher number of analysts may restrict spending on CSR, disciplining managers (Adhikari, 2016) and because analysts put pressure on managers to meet short-term targets, causing managers to stop investing in ESG aspects (Qian et al., 2019).

In relation to control variables, board size has a negative and significant relationship with systematic risk, at quartiles (0.50,0.75 and 0.90), suggesting that in higher risk firms, larger boards monitor managers better, however, board size has a negative and insignificant at quartiles 0.10 and 0.25, respectively, indicating that in lower risk firms, board size does not negatively influence systematic risk, thus board size does not influence systematic risk. Profitability negatively influences systematic risk in all quartiles (0.10, 0.25, 0.50, 0.75, 0.90), suggesting that more profitable firms have more resources and stability, thus decreasing systematic risk (Hassan et al., 2021; Rehman et al., 2020; Xue et al., 2020). Leverage has a positive and significant relationship with systematic risk, showing that more leveraged (more indebted) firms have higher systematic risk because it increases the firm's financing costs (Albuquerque et al., 2019; Rehman et al., 2020; Zeng et al., 2020). Finally, the results showed a positive relationship between firm size and systematic risk, suggesting that larger firms seem to think they can take more risk (Farah et al., 2021). Table 6 summarizes the acceptance or rejection of all hypotheses.

Table 6

Acceptance or rejection of the hypotheses

Hypothesis	**Level of support**
Hypothesis 1: ESG performance is negatively related to systematic risk	Accepted
Hypothesis 2: Environmental innovation has a negative moderating effect on the relationship between ESG and systematic risk	Rejected
Hypothesis 3: Analyst coverage has a negative moderating effect on the relationship between ESG and systematic risk	Rejected

In sum, the empirical results show that ESG negatively influences firms' systematic risk, supporting hypothesis 1. However, the results indicate that environmental innovation does not moderate the ESG - systematic risk nexus, rejecting hypothesis 2. Finally, we conclude that analyst coverage does not moderate the relationship between ESG and systematic risk, rejecting hypothesis 3.

5 Concluding remarks

This study examined the relationship between ESG and systematic risk of firms. Using data from 6371 annual observations of 2079 emerging country firms that make up the Morgan Stanley Capital International (MSCI) Emerging Markets Index over the period 2015-2020. We measure systematic risk by the CAPM beta and ESG by the ESG score provided by the Refinitiv

database. We use quantile regression at the 0.10, 0.25, 0.50, 0.75 and 0.90 percentiles in the study. The results show that ESG negatively influences firm systematic risk at all quartiles, supporting hypothesis 1. The results also indicate that environmental innovation and analyst coverage do not moderate the ESG-risk nexus, rejecting hypotheses 2 and 3. Finally, the results suggest that firm size and leverage positively influence systematic risk and that profitability negatively influences systematic risk.

We consider ESG a valuable strategic tool that companies can use to reduce their systematic risk, so managers could invest more in ESG activities and policy makers could support initiatives to increase companies' ESG performance. Moreover, the empirical results indicate a path for firms to decrease their systematic risk: investment in ESG practices. The insignificant results suggest that in companies with greater environmental innovation, ESG activities do not influence the systematic risk, this may be the effect of the high initial costs in environmental innovation, thus, it would be prudent that managers make an analysis of the economic situation of the company before investing in environmental innovation. The insignificant results indicate that in companies with a higher number of analysts, ESG investment does not influence systematic risk, this can be explained by the pressure exerted by analysts for companies to have short-term profits, this way, it would be advisable that managers have a greater balance when making decisions based on analysts' opinions, attending to short-term and long-term interests.

The insignificant results show that larger boards do not seem to influence systematic risk. It would be advisable for companies with large boards to focus on developing measures to decrease their systematic risk, it may be that the large number of individuals on the board are decreasing the effectiveness of board decisions. The positive results suggest that firm size positively influences systematic risk, in this sense, larger firms tend to think that because they have more assets they can run more systematic risk, thus, it would be advisable for managers of large firms to pay more attention to the systematic risk of the firms and that they take actions to change this reality.

Theoretically, the results imply that companies with higher ESG performance have unique resources and meet stakeholder needs, contributing new insights into the resource-based view and stakeholder theory. The results also indicate that in firms with lower systematic risk (quartiles 0.10, 0.25 and 0.50), better ESG performance influences more significantly the decrease in systematic risk, suggesting that in these firms higher ESG investment brings more results. Given this finding, policymakers could develop regulations to increase ESG investment in firms with lower systematic risk.

The study suffers from limitations. First, few companies made ESG information available. Second, the study only takes a quantitative approach. Third, we used only systematic risk. Finally, other countries could be used in the sample, so future research could use ESG information from other bases, such as Bloomberg, future studies could conduct an in-depth qualitative approach to understand the ESG - systematic risk relationship, as well as future research could use other types of risk, such as total market risk (stock volatility) and idiosyncratic risk (firm specific risk) and finally, other countries could be analyzed to understand the institutional characteristics of each country.

References

Aastvedt, T. M., Behmiri, N. B., & Lu, L. (2021). Does green innovation damage financial performance of oil and gas companies? *Resources Policy*, *73*, 102235.

Adhikari, B. K. (2016). Causal effect of analyst following on corporate social responsibility. *Journal of Corporate Finance*, *41*, 201–216. https://doi.org/https://doi.org/10.1016/j.jcorpfin.2016.08.010

Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, *65*(10), 4451–4469.

Andries, P., & Stephan, U. (2019). Environmental innovation and firm performance: How firm size and motives matter. *Sustainability*, *11*(13), 3585.
Aqif, T., & Wahab, A. (2021). Developing an understanding of the determinants, disclosures, and outcomes of CSR practices – a focus on developed and developing countries: a past review of 10 years. *Journal of Global Responsibility*, *12*(3), 289–316.
Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108
Barros, V., Falcão, P. F., & Sarmento, J. M. (2021). Are more sustainable firms able to operate with lower working capital requirements? *Finance Research Letters*, 102407.
Baulkaran, V., & Bhattarai, S. (2020). Board effectiveness: Evidence from firm risk. *Journal of Economics and Business*, *110*, 105907.
Biswas, S. (2021). Female directors and risk-taking behavior of Indian firms. *Managerial Finance*.
Brahmana, R. K., You, H., & Lau, E. (2020). Does reputation matter for firm risk in developing country? *International Journal of Finance & Economics*.
Brealey, R., & Myers, S. (2000). *Principles of corporate finance* (McGraw-Hil).
Burkhardt, K., Nguyen, P., & Poincelot, E. (2020). Agents of change: Women in top management and corporate environmental performance. *Corporate Social Responsibility and Environmental Management*, *September 2019*, 1–14. https://doi.org/10.1002/csr.1907
Chen, Y., & Ma, Y. (2021). Does green investment improve energy firm performance? *Energy Policy*, *153*, 112252.
Cheng, G., Zhao, C., Iqbal, N., Gülmez, Ö., Işik, H., & Kirikkaleli, D. (2021). Does energy productivity and public-private investment in energy achieve carbon neutrality target of China? *Journal of Environmental Management*, *298*, 113464.
Chiaramonte, L., Dreassi, A., Girardone, C., & Piserà, S. (2021). Do ESG strategies enhance bank stability during financial turmoil? Evidence from Europe. *The European Journal of Finance*, 1–39.
Chintrakarn, P., Jiraporn, P., & Treepongkaruna, S. (2021). How do independent directors view corporate social responsibility (CSR) during a stressful time? Evidence from the financial crisis. *International Review of Economics & Finance*, *71*, 143–160.
Christmann, P. (2000). Effects of "best practices" of environmental management on cost advantage: The role of complementary assets. *Academy of Management Journal*, *43*(4), 663–680.
Chun, H.-M., & Shin, S.-Y. (2018). Does analyst coverage enhance firms' corporate social performance? Evidence from Korea. *Sustainability*, *10*(7), 2561.
Davino, C., Furno, M., & Vistocco, D. (2013). *Quantile regression: theory and applications* (Vol. 988). John Wiley & Sons.
de Lucia, C., Pazienza, P., & Bartlett, M. (2020). Does good ESG lead to better financial performances by firms? Machine learning and logistic regression models of public enterprises in Europe. *Sustainability*, *12*(13), 5317.
Dhaliwal, D. S., Radhakrishnan, S., Tsang, A., & Yang, Y. G. (2012). Nonfinancial disclosure and analyst forecast accuracy: International evidence on corporate social responsibility disclosure. *The Accounting Review*, *87*(3), 723–759.
Djoutsa Wamba, L., Sahut, J., Braune, E., & Teulon, F. (2020). Does the optimization of a company's environmental performance reduce its systematic risk? New evidence from European listed companies. *Corporate Social Responsibility and Environmental Management*, *27*(4), 1677–1694.
Farah, T., Li, J., Li, Z., & Shamsuddin, A. (2021). The non-linear effect of CSR on firms' systematic risk: International evidence. *Journal of International Financial Markets,*

Institutions and Money, *71*, 101288. https://doi.org/https://doi.org/10.1016/j.intfin.2021.101288
Farooq, O., & Satt, H. (2014). Does analyst following improve firm performance? Evidence from the MENA region. *Corporate Ownership and Control*, *11*(2), 145–154.
Farooq, O., Satt, H., & Bendriouch, F. (2021). Effect of advertising expenditures on analyst coverage: evidence from an emerging market. *International Journal of Emerging Markets*.
Freeman, R. E. (2015). Stakeholder theory. *Wiley Encyclopedia of Management*, 1–6.
Freeman, R. E., Dmytriyev, S. D., & Phillips, R. A. (2021). Stakeholder theory and the resource-based view of the firm. *Journal of Management*, 0149206321993576.
Gangi, F., D'Angelo, E., Daniele, L. M., & Varrone, N. (2020). The impact of corporate governance on social and environmental engagement: what effect on firm performance in the food industry? *British Food Journal*.
Garcia, A. S., Mendes-Da-Silva, W., & Orsato, R. J. (2017). Sensitive industries produce better ESG performance: Evidence from emerging markets. *Journal of Cleaner Production*, *150*, 135–147.
García-Sánchez, I., Gallego-Álvarez, I., & Zafra-Gómez, J. (2021). Do independent, female and specialist directors promote eco-innovation and eco-design in agri-food firms? *Business Strategy and the Environment*, *30*(2), 1136–1152.
García-Sánchez, I., Hussain, N., Khan, S., & Martínez-Ferrero, J. (2021). Assurance of corporate social responsibility reports: Examining the role of internal and external corporate governance mechanisms. *Corporate Social Responsibility and Environmental Management*.
García-Sánchez, I.-M., Hussain, N., Khan, S.-A., & Martínez-Ferrero, J. (2020). Do markets punish or reward corporate social responsibility decoupling? *Business & Society*,
Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 101889.
Hassan, M. K., Chiaramonte, L., Dreassi, A., Paltrinieri, A., & Piserà, S. (2021). The Crossroads of ESG and Religious Screening on Firm Risk. *Research in International Business and Finance*, 101500.
Hinze, A.-K., & Sump, F. (2019). Corporate social responsibility and financial analysts: a review of the literature. *Sustainability Accounting, Management and Policy Journal*, *10*(1), 183–207.
Hizarci-Payne, A. K., İpek, İ., & Kurt Gümüş, G. (2021). How environmental innovation influences firm performance: A meta-analytic review. *Business Strategy and the Environment*, *30*(2), 1174–1190. https://doi.org/https://doi.org/10.1002/bse.2678
Ho, J., Lu, C., & Lucianetti, L. (2021). Does engaging in corporate social responsibility activities influence firm performance? The moderating effects of risk preferences and performance measurement systems. *Management Decision*.
Jo, H., & Harjoto, M. (2014). Analyst coverage, corporate social responsibility, and firm risk. *Business Ethics: A European Review*, *23*(3), 272–292.
Kalash, I. (2021). Corporate sustainability performance in the emerging market of Turkey: the role of accounting information quality and firm risk. *Journal of Economic and Administrative Sciences*.
Kim, J.-M., Cho, C., Jun, C., & Kim, W. Y. (2020). The Changing Dynamics of Board Independence: A Copula Based Quantile Regression Approach. *Journal of Risk and Financial Management*, *13*(11), 254.
Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: Journal of the Econometric Society*, 33–50.
Koenker, R., & Hallock, K. F. (2001). Quantile regression. *Journal of Economic Perspectives*, *15*(4), 143–156.

Li, K. (2020). Does information asymmetry impede market efficiency? Evidence from analyst coverage. *Journal of Banking & Finance*, *118*, 105856.
Liang, Z., Liu, Y., Xu, Y., & Wagner, T. (2021). Bayesian change point quantile regression approach to enhance the understanding of shifting phytoplankton-dimethyl sulfide relationships in aquatic ecosystems. *Water Research*, *201*, 117287.
Liao, Z. (2018). Corporate culture, environmental innovation and financial performance. *Business Strategy and the Environment*, *27*(8), 1368–1375.
Liao, Z., Liu, P., & Liu, S. (2021). A meta-analysis of environmental innovation and firm performance. *Journal of Environmental Planning and Management*, *64*(11), 2047–2065.
Long, X., Chen, Y., Du, J., Oh, K., Han, I., & Yan, J. (2017). The effect of environmental innovation behavior on economic and environmental performance of 182 Chinese firms. *Journal of Cleaner Production*, *166*, 1274–1282.
Lu, Y., & Abeysekera, I. (2021). Do investors and analysts value strategic corporate social responsibility disclosures? Evidence from China. *Journal of International Financial Management & Accounting*, *32*(2), 147–181.
Lueg, K., Krastev, B., & Lueg, R. (2019). Bidirectional effects between organizational sustainability disclosure and risk. *Journal of Cleaner Production*, *229*, 268–277.
Martins, O. S., & de Campos Barros, L. A. B. (2021). Firm Informativeness, Information Environment, and Accounting Quality in Emerging Countries. *The International Journal of Accounting*, *56*(01), 2150004.
Maxfield, S., & Wang, L. (2020). Does sustainable investing reduce portfolio risk? A multilevel analysis. *European Financial Management*.
Mohammad, W. M. W., & Wasiuzzaman, S. (2021). Environmental, Social and Governance (ESG) disclosure, competitive advantage and performance of firms in Malaysia. *Cleaner Environmental Systems*, *2*, 100015.
Mohanty, S. S., Mohanty, O., & Ivanof, M. (2021). Alpha enhancement in global equity markets with ESG overlay on factor-based investment strategies. *Risk Management*, 1–30.
Mouselli, S., & Hussainey, K. (2014). Corporate governance, analyst following and firm value. *Corporate Governance*.
MSCI. (2021). *MSCI Emerging Markets Index*.
Naqvi, S. K., Shahzad, F., Rehman, I. U., Qureshi, F., & Laique, U. (2021). Corporate social responsibility performance and information asymmetry: The moderating role of analyst coverage. *Corporate Social Responsibility and Environmental Management*.
Oware, K. M., & Mallikarjunappa, T. (2021). Corporate social responsibility and debt financing of listed firms: a quantile regression approach. *Journal of Financial Reporting and Accounting*.
Popkova, E., DeLo, P., & Sergi, B. S. (2021). Corporate Social Responsibility Amid Social Distancing During the COVID-19 Crisis: BRICS vs. OECD Countries. *Research in International Business and Finance*, *55*, 101315. https://doi.org/https://doi.org/10.1016/j.ribaf.2020.101315
Qian, C., Lu, L. Y., & Yu, Y. (2019). Financial analyst coverage and corporate social performance: Evidence from natural experiments. *Strategic Management Journal*, *40*(13), 2271–2286.
Qoyum, A., Sakti, M. R. P., Thaker, H. M. T., & AlHashfi, R. U. (2021). Does the Islamic Label Indicate Good Environmental, Social, and Governance (ESG) Performance? Evidence from Sharia-Compliant Firms in Indonesia and Malaysia. *Borsa Istanbul Review*.
Reber, B., Gold, A., & Gold, S. (2021). ESG Disclosure and Idiosyncratic Risk in Initial Public Offerings. *Journal of Business Ethics*, 1–20.
Refinitiv. (2021). *Environmental, Social and Governance (ESG) Scores from Refinitiv*.

Rehman, Z. ur, Khan, A., & Rahman, A. (2020). Corporate social responsibility's influence on firm risk and firm performance: the mediating role of firm reputation. *Corporate Social Responsibility and Environmental Management*, *27*(6), 2991–3005.

Rennings, K. (2000). Redefining innovation—eco-innovation research and the contribution from ecological economics. *Ecological Economics*, *32*(2), 319–332.

Rennings, K., & Rammer, C. (2011). The impact of regulation-driven environmental innovation on innovation success and firm performance. *Industry and Innovation*, *18*(03), 255–283.

Salehi, M., Arianpoor, A., & Naghshbandi, N. (2021). The relationship between managerial attributes and firm risk-taking. *The TQM Journal*.

Salehi, M., Dashtbayaz, M. L., & Abdulhadi, K. H. (2020). The relationship between managerial entrenchment and firm risk-taking on social responsibility disclosure. *Journal of Public Affairs*, e2511.

Sardaro, R., De Pascale, G., Ingrao, C., & Faccilongo, N. (2021). Latent relationships between environmental impacts of cultivation practices and land market: Evidences from a spatial quantile regression analysis in Italy. *Journal of Cleaner Production*, *279*, 123648.

Shakil, M. H. (2021). Environmental, social and governance performance and financial risk: Moderating role of ESG controversies and board gender diversity. *Resources Policy*, *72*, 102144.

Sharma, D., Bhattacharya, S., & Thukral, S. (2019). Resource-based view on corporate sustainable financial reporting and firm performance: evidences from emerging Indian economy. *International Journal of Business Governance and Ethics*, *13*(4), 323–344.

Shiah-Hou, S.-R. (2016). The effect of analyst coverage on CEO compensation structure: evidence from the S & P 1500. *Managerial Finance*.

Töbelmann, D., & Wendler, T. (2020). The impact of environmental innovation on carbon dioxide emissions. *Journal of Cleaner Production*, *244*, 118787. https://doi.org/https://doi.org/10.1016/j.jclepro.2019.118787

Ullah, S., & Nasim, A. (2021). Do firm-level sustainability targets drive environmental innovation? Insights from BRICS Economies. *Journal of Environmental Management*, *294*, 112754.

Wang, S., Wang, H., Wang, J., & Yang, F. (2020). Does environmental information disclosure contribute to improve firm financial performance? An examination of the underlying mechanism. *Science of the Total Environment*, *714*, 136855.

Weche, J. P. (2015). *Does green corporate investment really crowd out other business investment?* Working Paper Series in Economics.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Xiao, J., Hu, C., Ouyang, G., & Wen, F. (2019). Impacts of oil implied volatility shocks on stock implied volatility in China: Empirical evidence from a quantile regression approach. *Energy Economics*, *80*, 297–309.

Xue, B., Zhang, Z., & Li, P. (2020). Corporate environmental performance, environmental management and firm risk. *Business Strategy and the Environment*, *29*(3), 1074–1096.

Yang, J., Wang, R., & Xue, Y. (2020). Analyst coverage and corporate misconduct. *Australian Economic Papers*, e12203.

Zaman, R., Atawnah, N., Haseeb, M., Nadeem, M., & Irfan, S. (2021). Does corporate eco-innovation affect stock price crash risk? *The British Accounting Review*, 101031.

Zeng, H., Zhang, T., Zhou, Z., Zhao, Y., & Chen, X. (2020). Water disclosure and firm risk: Empirical evidence from highly water-sensitive industries in China. *Business Strategy and the Environment*, *29*(1), 17–38.