Environmental Performance and Financial Constraints in Emerging Markets

Henry Agyei-Boapeah
Department of Accounting, Nottingham University Business School,
University of Nottingham, Nottingham, UK.
Corresponding author's E-mail: henry.agyei-boapeah@nottingham.ac.uk

Neytullah Ciftci

Department of Business Administration,
Faculty of Economics and Administrative Sciences,
Hakkari University, Hakkari, Türkiye.
E-mail: n.ciftci@hakkari.edu.tr

John Malagila
Department of Accounting, Essex Business School,
University of Essex, Colchester, UK.
E-mail: j.k.malagila@essex.ac.uk

Jennifer Brodmann
Department of Accounting, Finance and Economics,
California State University Dominguez Hills,
Carson, CA, USA.
E-mail: jbrodmann@csudh.edu

Samuel Fosu
Department of Accounting and Finance,
University of Sussex, Brighton, UK
E-mail: s.fosu@sussex.ac.uk

Keywords: *Environmental performance, Financial constraints, Carbon emission, Emerging economies*

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Abstract

We examine how corporate environmental performance relates to financial constraints in an environment likely to face high global pressure to address climate change. Using multivariate regressions and a large dataset of over 8,500 firm-years from 24 emerging market countries during a period of 18 years from 2003 to 2020, we find superior environmental performance (especially relating to carbon emissions) to be associated with significantly lower levels of financial constraints. This finding is robust to an alternative measure of financial constraints, different sample compositions, and to endogeneity concerns. Further analyses reveal that the reductions in financial constraints are significantly higher for firms: (i) in high carbon-emitting countries; (ii) in countries that adopted the 2015 Paris Climate Agreement early; and (iii) that cross-list onto foreign stock exchanges. Finally, we provide evidence to suggest that the environmental aspects of a firm's CSR efforts mitigate its financial constraints more than can be attained by the other major CSR dimensions. Overall, the findings imply that stakeholders of emerging market firms prioritise environmental concerns and, therefore, reward environmentally responsible firms with cheaper and easier access to financing, especially when global environmental concerns are high.

Keywords: *Environmental performance, Financial constraint, Carbon emission, Emerging economies*

1. Introduction

In recent years, managers and investors seem to have devoted more attention and resources to environmental and sustainability matters. For example, the latest United Nations (UN) Global Compact-Accenture CEO survey (2019) suggests that 71% of CEOs of the world's largest corporations believe that they need to increase their commitments and actions to global goals including sustainability and climate change. The report further points out growing investor interest in sustainability since CEOs citing lack of recognition from investors as a sustainability barrier dropped from 34% in 2010 to 13% in 2019. Similarly, according to the 2018 Report of the US Forum for Sustainable and Responsible Investment, environmentally friendly investments in the US increased from US$8.7 trillion in 2016 to US$12 trillion in 2018.[1] Importantly, this tremendous growth in environmentally friendly assets is observed at the time when the major asset managers and institutional investors cite climate change/carbon emissions as a topmost issue for them.[2]

These recent developments imply that at least one of the key corporate stakeholder groups – investors – is becoming increasingly concerned about the environment. An example of this can be seen with activist investor Engine No. 1, a hedge fund that succeeded in replacing two Exxon Mobil board members to address the lack of firm investment in alternative energy.[3] The market rewarded their efforts with Exxon's stock price increasing by 45 per cent from the beginning of the campaign. Perhaps, this increased environmental concern by investors is due to intense global pressure for environmental action from civil society groups and environmental activists.[4] If major corporate financiers (including investors) become more responsive

[1]The full Report is available here: https://www.ussif.org/trends or https://www.ussif.org/files/US%20SIF%20Trends%20Report%202018%20Release.pdf [Accessed on 18/02/20].
[2] See FT publication 11/12/20: https://www.ft.com/content/d77d5ecb-4439-4f6b-b509-fffa42c194db?shareType=nongift [Accessed on 14/09/21].
[3]See the New York Times publication: https://www.nytimes.com/2021/06/09/business/exxon-mobil-engine-no1-activist.html [Accessed on 14/09/21].
[4]For example, in October 2019, Extinction Rebellion – a campaign movement – organized a protest which shut down Westminster (UK Parliament) in calls for environmental action. This was part of an "international rebellion" around the world, with similar action taking place in cities such as Berlin, Madrid, Amsterdam, and New York. See link: https://www.shropshirestar.com/news/uk-news/2019/10/07/extinction-rebellion-shuts-down-westminster-in-call-for-environmental-action/ [Accessed on 24/07/20].

to environmental concerns, then, they may act through the market mechanism to motivate managers to develop and adopt environmentally friendly business models and strategies. Surprisingly, however, the issue of whether and how capital markets encourage firms to become environmentally responsible have received little attention in the academic literature. The present study seeks to contribute towards filling this gap by examining how a firm's environmental performance relates to its level of financial constraint.

We expect firms with superior environmental performance to be rewarded by financiers through cheaper and easier access to finance, particularly where environmental degradation is acute to attract high stakeholder pressure from foreign institutional investors. We argue that given the increased levels of emissions in emerging markets in the last decade (see Figure 1), emerging market firms and their stakeholders will face intense global pressure to act responsibly (Ko *et al.,* 2021). This will give such firms a stronger incentive to commit more to environmentally responsible practices (Arora and De, 2020). Our argument is underpinned by the stakeholder theory and the legitimacy theory which hold that both firms and capital markets are not merely a means by which goods and services can be efficiently produced, but are also units for upholding high cultural, ethical, moral, and social values (Haque and Ntim, 2020; Meyer and Rowan, 1977). Therefore, where there is a high concern for climate change and environmental issues, firms could make economic gains if they respond favourably to environmental concerns. From this theoretical standpoint, we posit that to the extent that important stakeholders such as investors, customers and governments cherish environmental sustainability, firms that exhibit a greater commitment to climate action and environmental sustainability may eventually enjoy competitive advantages such as favourable financing terms that could ultimately translate into lower levels of financial constraints.

[PLEASE INSERT FIG. 1 HERE]

Based on multivariate regressions that control for several firm-, year-, industry-, and country-level characteristics and a large dataset of over 8,500 firm-years across 24 emerging market economies over the period 2003-2020, we provide new empirical insights. First, we find that firms that improve their overall environmental performance by one standard deviation experience an average of 26% reduction in their

levels of financial constraints. Relatedly but focusing on environmental emissions, we also find that firms enjoy an average of 17% reductions in their levels of financial constraints when they improve their environmental emission performance by one standard deviation. Taken together, these results underscore the importance of environmental emissions in the sustainability agenda – since over 65% of our estimated economic gains from environmental sustainability are associated with reducing environmental emissions.

Given that emerging market countries face varying levels of political and public pressure to respond to environmental concerns (Desender and Epure, 2021), we further explore how our baseline results may change for firms in different operating environments. We show that the reduced financial constraints that emanate from better environmental performance are significantly higher for firms in high carbon-emitting countries (i.e., those emerging market countries contributing more than 1% to global emissions). Specifically, firms in high carbon-emitting countries enjoy an additional 14% (16%) reduction in their levels of financial constraints over their counterparts elsewhere when they improve their environmental (emission) performance by one standard deviation. This implies that where environmental concerns are severe, external stakeholders such as investors use the market mechanism to get firms to behave responsibly by offering stronger incentives. This finding is consistent with Antonini et al. (2021) who report greater incentives for US firms in carbon-intensive industries to engage in more climate change disclosures. Finally, we provide evidence to suggest that the lower levels of financial constraints associated with environmental performance are significantly higher for firms in countries that adopted the 2015 Paris Climate Agreement early. To the extent that early adoption of global environmental interventions (e.g., the 2015 Paris Climate Agreement) proxies for political and public pressure for environmental action, this result confirms our view that investors offer greater rewards to environmentally responsible firms where there are stronger societal concerns for the environment.

Finally, we find that environmental performance has a greater impact on a firm's levels of financial constraints than the other major corporate social responsibility (CSR) dimensions, including social, community, and governance. Specifically, in a full model containing all the major dimensions of CSR, we

find that only the environmental and social dimensions of a firm's CSR efforts significantly reduce financial constraints. A one standard deviation improvement in environmental performance leads to 18% reductions in financial constraints while the same improvement in social performance results in only 14% reductions in financial constraints. These findings suggest that investors may prioritise environmental concerns over and above the other CSR dimensions and thus offer stronger incentives for environmental performance than for other CSR efforts.

Our findings are novel and make important contributions to the sustainability literature as well as to corporate and public policy. First, we contribute to the extant literature on the economic consequences of pursuing sustainability practices (e.g., Haque and Ntim, 2020; Benlemlih and Bitar, 2018; Cheng *et al.,* 2014). Unlike most prior studies, we focus on environmental performance rather than on the broader concept of CSR, thus, providing a richer environmental analysis that ultimately generates more specific (relevant) information for environmental stakeholders. A few studies have examined the link between some facets of environmental responsibility and economic outcomes, but these often subsume environmental responsibility within the broader concept of CSR (Benlemlih and Bitar, 2018; Cheng *et al.,* 2014; Cho *et al.,* 2013). For instance, Cheng *et al.* (2014) report that firms with better CSR performance face significantly lower capital constraints. We contribute to this literature by showing that environmental performance affects firms' access to financial resources beyond the general effect of CSR.

This contribution is significant because although most scholars see environmental performance as a subset of CSR, there is growing interest in and increasing calls for a greater focus on the environmental dimension of CSR (see e.g., Hao and Kang, 2019; Cai *et al.,* 2016; Welford *et al.,* 2007). Welford *et al*.'s (2007) report that external stakeholders view the environment as one of their top priorities in the firms' CSR efforts. Therefore, while the findings of prior studies linking CSR to corporate economic outcomes can enable economic and social stakeholders to make a general assessment of a firm's social performance, they fail to provide the fine-grained information that permits specific stakeholders (e.g., environmental activists and policy makers) to make a more informed judgement about a firm's environmental

performance. By focusing on firms' environmental performance (rather than on the broader concept of CSR), we provide findings that potentially enhance the quality of information available to environmental stakeholders, and, in the process, contribute to recent studies that highlight the benefits of providing quality and reliable environmental disclosures. For example, Paananen, Runesson, and Samani (2021) report that providing specific environmental liabilities disclosure in firms' annual reports is associated with lower information asymmetry and bid-ask spread. Birkey, Michelon, Patten, and Sankara (2016) also show that boosting environmental information reliability by seeking assurance on standalone CSR reports increases firms' environmental reputation.

Further, our focus on emerging markets is important. In an extensive review of studies on environmental responsibility, Holtbrügge and Dögl (2012) report an overall dearth of research on corporate environmental responsibility, but even within this small pool of academic research, studies on emerging economies are hugely underrepresented. They further lament that the handful of emerging market studies in this research area tend to be locally rather than internationally situated. For example, Tian and Lian's (2019) study of the impact of financing constraint on environmental performance only focused on the Chinese context.[5] Our cross-country study of 24 emerging market economies adds to this nascent but growing literature and could offer guidance to policy makers to help curb the rising carbon emissions in emerging markets (see Fig. 1). Relatedly, there is growing interest in understanding why there is a surge in firms' voluntary environmental management practices in emerging economies (Tatoglu *et al.*, 2014; Tatoglu *et al.*, 2020), despite the existence of relatively lenient environmental regulations and enforcement regimes in these countries (e.g., see Blackman, 2008; Su *et al.*, 2016). Our findings partly address this question by suggesting that the recent global environmental pressure faced by high carbon-emitting countries coupled with more

[5]The current study differs in several ways from Tian and Lian (2019). First, the present study is cross-country, so has implications beyond China. Second, Tian and Lian's interest is in how financial constraints influence environmental performance, but the reverse is the focus of the current paper. Third, the current study has several other extensions, including examining the moderating roles of high levels of emission, cross-listing, adoption of the Paris Accord, among others.

investors embracing the social value of environmental responsibility make it economically beneficial for emerging market firms to be environmentally responsible.

Last, we contribute to the extensive literature on corporate financial constraints (Balafas and Kostakis, 2017; Bayer *et al.*, 2018; Chen *et al.*, 2017; Erel *et al.*, 2015; Livdan *et al.*, 2009) by providing empirical evidence on the relationship between environmental performance and financial constraint. Specifically, our study reflects the association between environmental performance and financial constraints in emerging economies, and more importantly, documents where this relationship is strongest. Given that financial constraints represent a major challenge for firms in developing countries (Agyei-Boapeah and Machokoto, 2018), our finding is important because it offers a social channel (i.e., environmental performance) through which firms in emerging markets could mitigate their financial constraints and enhance their growth prospects.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature and develops hypotheses, while Section 3 discusses the data and methodology. The analysis and findings are presented and discussed in Section 4, followed by a conclusion in Section 5.

2. Literature review

2.1 Financial constraint

Finance theory holds that firms should face no financial constraints in perfect capital markets because internal and external sources of finance are substitutes (Modigliani and Miller, 1958; Agyei-Boapeah, 2015). In practice, however, the imperfections in capital markets such as the information asymmetry between insiders and outsiders (Myers and Majluf, 1984) and the agency conflicts between managers and investors (Gertler, 1992) cause outsider investors to demand for the cost of external financing to be higher than that of internal financing. Consequently, in the absence of sufficient internal financing, a firm would face financial constraints if it cannot access external financing from investors at a reasonable cost (Kaplan

and Zingales, 1997). Financial constraints can be costly to firms by causing underinvestment problems due to the lack of financing opportunities (Gamba and Triantis, 2008).

One strand of the literature investigates which types of firms are more likely to face financial constraints. These studies highlight firm size (Carpenter and Petersen, 2002), life cycle (Muller and Zimmermann, 2009), ownership structure and political affiliation (Shen and Lin, 2016; Lin *et al.,* 2017), among others, as key determinants of financial constraints. For instance, Carpenter and Petersen (2002) suggest that investors are discouraged from providing capital to small firms because they usually have severe information asymmetry, high stock price volatility, and insufficient collateral assets. A firm faces higher levels of financial constraints when it is young and in the initial phases of its life cycle but are gradually alleviated as it grows (Muller and Zimmermann, 2009).

A parallel stream of literature emphasizes factors that ease the firm's level of financial constraint. In particular, the studies suggest that financial liberalization (Chan *et al.,* 2012), foreign direct investments (Harrison *et al.*, 2004), cross-listing (Chen *et al.*, 2021), and information disclosures (Cheng *et al.*, 2014) can ease financial constraints. For example, foreign direct investments mitigate financial constraints for domestic firms by directly providing funds (Harrison *et al.,* 2004) and bypassing domestic legal barriers (Chen and Luo, 2014). Chen *et al.* (2021) report that non-US firms, especially smaller ones, that cross-list on US stock markets experience significant reductions in their levels of financial constraints. Kim and Sohn (2013) show that earnings management aggravates financial constraints by raising a firm's opacity. Cheng *et al.* (2014) document that CSR disclosures reduce the firm's levels of financial constraint by improving transparency and stakeholder engagements.

The current study closely relates to, but also differs in important ways from Cheng *et al.* (2014). First, the present study examines the specific issue of corporate environmental responsibility which arguably deserves attention in its own right in recent years. As we argue in the next section, key corporate stakeholders are increasingly interested in environmental performance, thus, it is important to understand how a firm's response to environmental concerns affects its ability to access resources. Thus, the present

study contributes to the literature by exploring the incremental value of environmental responsibility beyond general CSR. Second, the present study focuses on firms in emerging markets where financial constraints are more binding and where recent environmental concerns are strongest. Lastly, while Cheng *et al.*'s (2014) analysis was based on a dataset ending in 2009, the current study covers a more recent sample period (2003-2020). This updated sample period permits a robust analysis of the impact of recent global environmental interventions such as the 2015 Paris Agreement on corporate outcomes.

2.2 The link between environmental performance and financial constraint

Over the past two decades, there have been tremendous shifts in the preferences of key stakeholders of the firm – shareholders, lenders, and customers – towards ethical issues and environmental sustainability in such a way as to be able to significantly impact the firm's levels of financial constraints beyond the general impact of CSR documented in the literature (e.g., Cheng et al., 2014). Interestingly, the same period witnessed two major global climate change interventions; namely, the 1997 Kyoto Protocol and the 2015 Paris Agreement. In this section, we present anecdotal evidence to suggest that these environmental interventions, among others, have raised awareness of climate concerns and brought political pressure on governments and other corporate stakeholders to take action to specifically address climate risk. We also discuss how major stakeholders can influence the environmental practices of firms. Specifically, we focus on how the environmental concerns of three corporate stakeholders – shareholders, lenders, and customers – could be linked to financial constraints at the firm level.

First, shareholders' environmental concerns can impact firms' financial constraints through the cost of equity financing and filing shareholder resolutions. According to Fama and French (2007), investors' taste and preferences for assets affect asset prices. Thus, shareholders' tastes and preferences for environmentally responsible investments can affect the share prices of firms. Theoretically, if environmental concerns can cause a sufficiently large number of shareholders to refrain from investing in environmentally irresponsible firms, the expected return (i.e., cost of equity capital) of such firms would increase (Gollier and Pouget,

2009), making it more difficult and costly for them to raise capital from the external equity market. The growth of about 324% in responsible/sustainable investments over the 1995-2007 period (Chava, 2014) provides anecdotal evidence that more and more investors are increasing their appetite for social and environmental investments. There is also empirical evidence to suggest that investors consider the environmental profile of firms in assessing their risks and returns. For instance, Sharfman and Fernando (2008) and El Ghoul *et al.* (2018) show that firms have higher cost of equity capital when they exhibit poorer environmental performance. Similarly, for a sample of over 3000 firms during 1990-2013, Ng and Rezaee (2015) demonstrate that poor sustainability performance increases firms' cost of equity.

Moreover, potential and existing shareholders can influence corporate environmental policies through direct engagement with management by way of lobbying, filing shareholder resolutions, and posing questions at the AGMs, and these practices are common in recent years. The Ceres Investor Network, representing over 195 institutional investors managing more than $37 trillion in assets, leverages its collective power to lobby companies and stock exchanges to promote climate action and sustainability practices.[6] Landier and Nair (2009) also report that almost 30% of shareholder resolutions filed in 2007 were socially/environmentally oriented. Furthermore, existing shareholders use the opportunity offered by annual general meetings (AGMs) to press the company's board to take environmental issues seriously. For example, at the 2021 AGM of Aviva plc (a UK insurance company and an institutional investor), six out of the 21 questions posed by shareholders were related to the environment. Some of these environmental questions called on the company to disinvest its holdings and desist from further investing in Adani Ports and Adaro Energy – Indian and Indonesian companies, respectively – for their connections with coal mining and fossil fuel activities.[7] This is a classic example of how a global concern such as climate change could cause shareholders of a British company to press on the company's board to use its capital allocation decisions to promote environmental action in emerging markets.

[6]See link for more details about the Ceres Investor Network: https://www.ceres.org/networks/ceres-investor-network

[7]See https://www.aviva.com/investors/meeting-agm-2021/ for details of the AGM.

Besides the influence of shareholders, the environmental concerns of lenders – another stakeholder group – could impact a firm's levels of financial constraint. In fact, the trends in the debt market appear to follow developments in the equity market. There has been a huge increase in the number of lenders incorporating environmental concerns in their lending decisions. Several large banks, including major emerging market banks that provide substantial project loans to firms, have adopted the Equator Principles (https://equator-principles.com/). The Equator Principles require project financing by participating banks to conform to global environmental and social policy framework. Currently, more than 117 financial institutions in over 36 countries have officially adopted the Equator Principles, and together these financial institutions cover over 70% of international project finance loans in emerging markets. Similarly, Cogan (2008) documents that several large, listed banks across the world have started considering climate change concerns in their lending decisions. These developments in the credit market have restricted access to credit to firms with poor environmental records by increasing their borrowing cost. Based on a large sample of bank loans issued to domestic firms, Chava (2014) reports that fewer banks participate in the loan syndicate of borrowers with environmental concerns, especially emission concerns. He also finds that firms with environmental concerns are charged a higher interest rate on their bank loans. Delis *et al.* (2019) document that borrowing firms' fossil fuel reserves (i.e., carbon emission potential) are positively related to the interest rates that banks charge. Similar conclusions can be drawn from the findings of Attig *et al.* (2013) and Weber *et al.* (2010). Therefore, like shareholders, lenders are increasingly becoming conscious of environmental risks, and may be limiting access to debt capital to environmentally irresponsible firms. This could result in higher (lower) levels of financial constraints for firms with poorer (better) environmental records.

Finally, environmental concerns can affect a firm's degree of financial constraint through the impact of public/customer opinion on profitability and operating cash flow. Previous studies suggest that commitment of firms to sustainability practices improves relations with customers, employees, and the public (Stanny and Ely, 2008; Devinney, 2011; Albuquerque *et al.*, 2019; Arora and De, 2020; Ko *et al.*, 2021). Based on

survey data of managers in Turkey, Tatoglu *et al.* (2020) find that as firms become more customer-focused and more inclined to pursue a stakeholder-oriented strategy, they implement voluntary environmental management practices. These environmental commitments improve the firm's profitability and cash flows by reducing uncertainty, strikes, boycotts, litigations, and overall business risk (Orlitzky and Benjamin, 2001). With respect to climate change, Stanny and Ely (2008) argue that companies generating higher carbon emissions are likely to face greater public pressure and product boycotts. A typical case of a boycott and severe reputational damage over environmental concerns is Shell in the Brent Spar incident in 1995 over the redundant oil storage installation in the North Sea (Dickson and McCulloch, 1996). It cost Shell £60 million to decommission the Brent Spar, not to mention the loss of revenue from the boycotts and reputational damage.[8] If a company operates responsibly, however, it does not only lower its risk of consumer boycotts and penalties but can also enhance its brand image to boost performance. Albuquerque *et al.* (2019) show that firms with better CSR and sustainability practices enjoy goodwill and support from the public, helping them to achieve product differentiation and customer loyalty. They further report that such firms leverage their product differentiation and customer loyalty to increase their product prices and profit margins. Arora and De (2020) find that firms engaging in environmental sustainability practices are able to boost their export revenues and profitability. To the extent that higher profitability improves the internal funding, firms with better environmental records may be able to reduce their financial constraints.

Collectively, the foregoing discussions demonstrate that environmental performance can influence a firm's levels of financial constraint through the actions of important stakeholders – shareholders, lenders, and the public/customers beyond the general effect of CSR. The actions of these stakeholders in response to the firm's environmental practices impact the firm's access to and cost of external capital (equity and debt), as well as its internal cash flow, which ultimately shape its levels of financial constraints.

[8]The full dossier on the Brent Spar can be found here: https://www.shell.co.uk/sustainability/decommissioning/brent-spar-dossier/_jcr_content/par/textimage.stream/1426853000847/32a2d94fa77c57684b3cad7d06bf6c7b65473faa/brent-spar-dossier.pdf

2.3 Theory and hypothesis development

Stakeholder theory is central to this study (Friedman, 2007; Freeman and McVea, 2000), but we also draw from the legitimacy theory (Molecke and Pinkse, 2020; Alon and Vidovic, 2015; Bansal and Clelland, 2004) to develop our hypothesis. Freeman and McVea (2000) contend that firms should make decisions that are aligned with the interest of groups who can be affected by the activities of the company: the stakeholders. The stakeholder theory holds that the capacity of a firm to generate sustainable wealth is determined by its relationships with its various stakeholders. Following this line of thinking, where key stakeholders value environmental sustainability, the firm should incorporate such values into its operations as much as possible. Doing so will bring the firm in harmony with its stakeholders, resulting in greater legitimacy for the firm that can be used to access valuable resources, including financial capital (Fernando and Lawrence, 2014; Suchman, 1995).

Applying these theoretical perspectives to our study, we posit that insofar as environmental concerns are of interest to key stakeholders (e.g., shareholders, lenders, customers, and the public) who can shape institutional standards, firms that have superior environmental records will obtain the legitimacy to access finance more easily than other firms. Bansal and Clelland (2004) suggest at least two main reasons why corporate environmental legitimacy may be advantageous to firms: (i) it offers better access to funds; and (ii) it isolates the firm from criticism and reputational damage. Overall, we posit that if key stakeholders of emerging market firms (especially the financiers) regard environmental responsibility to be important, then, financing advantages could emerge for firms with superior environmental performance. Thus, we expect emerging market firms with better environmental performance to have lower levels of financial constraints. We formally state this hypothesis below:

Hypothesis: *Firms with superior environmental performance would experience lower levels of financial constraints.*

3. Data and methodology

3.1 Data

To test our hypothesis, we rely on a sample of publicly listed firms in emerging market. We focus on emerging market firms because they face severe financial constraints due to relatively underdeveloped financial markets, weak corporate governance systems, and higher asymmetric information in emerging market countries (Agyei-Boapeah *et. al.*, 2020; Tunyi *et al.*, 2019; Chen *et al.*, 2017). Moreover, emerging market countries are responsible for a large proportion of the world's carbon emissions in recent years, as shown in Fig. 1. Thus, emerging markets provide us with a unique context to study the relationship between environmental performance and financial constraints.

We begin our data collection by retrieving a list of all publicly listed companies in emerging countries (see Panel B of Table 1 for the sample countries) through Datastream database.[9] The same database provides us with the accounting and financial data required to construct the variables for our study. To obtain environmental data, we turn to the environmental, social and governance (ESG) database provided by Thomson Reuters. However, most of the firms covered in the ESG database are from developed countries (mainly North America and Europe), with less than 30% coverage for emerging market firms. This perhaps explains why empirical research on environmental performance involving emerging market firms is rare. Besides, the environmental data for emerging market firms starts from 2002.

We also collect country-level variables from the International Monetary Fund's (IMF) database. After applying standard filters such as excluding financial firms and firms with missing data (see Erel, Jang and Weisbach, 2015), we end up with an unbalanced panel of 1,191 unique firms from 24 emerging market countries, covering the period 2003-2020. This gives us a final dataset of over 8,500 firm-year observations. The filtering process for arriving at the final dataset is presented in Panel A of Table 1. As shown in Panel

[9]We define emerging market countries based on the Financial Times Stock Exchange (FTSE) country classification, available at https://research.ftserussell.com/products/downloads/FTSE-Country-Classification-Update-2017.pdf [Accessed on 01/09/17].

B of Table 1, some countries such as Taiwan (14.17%), South Africa (12.31%), India (10.92%), China (10.87%), and Brazil (10.27) dominate the sample, with each contributing at least 10% to the sample. Later in Section 4.3.1, we test whether our main results are driven by firms in these countries.

[PLEASE INSERT TABLE 1 HERE]

3.2 Empirical model

To examine the relationship between environmental performance and financial constraints, we estimate a series of panel regressions with several control variables and fixed effects. Our baseline regression model is specified in Eq. (1):

$$FC_{ijt} = \beta_1 + \beta_2 EP_{ijt} + \sum_{k=1}^{k} X_{kijt}\,\beta_k + \gamma_t + \delta_j + \theta_i + \varepsilon_{ijt} \quad \text{Eq. (1)}$$

where FC_{ijt} is the level of financial constraint, defined in subsection 3.3.1, faced by firm *i* in country *j* at time *t*; and EP_{ijt} represents the environmental performance of firm *i* in country *j* at time *t*. The other parameters in Eq. (1) are β_1, which is the intercept; β_2 and β_k, representing vectors of parameters to be estimated; X_{kijt}, a vector of *k* control variables (explained below) for firm *i* in country *j* at time *t*; γ_t is the year-fixed effect; δ_i is the country-fixed effect; θ_i is the industry-fixed effect; and ε_{it} it is the error term. Following Chava (2014), we do not include firm-fixed effect in our baseline model due to the persistence of environmental variables over time. We, however, later test the robustness of our analysis to the inclusion of firm-fixed effect.

We include several standard control variables (X_{kijt}) that potentially affect a firm's degree of financial constraints. First, we control for firm size and age as small and younger firms tend to be associated with greater information asymmetry and thus face severe financing constraints (Carpenter and Petersen, 2002). We also include growth opportunities, asset growth and industry concentration to control for the stage of the firm and/or industry life cycle. Firms and industries at the early stages of the life cycle tend to face greater financing constraints (Muller and Zimmermann, 2009). To capture lending risks, we include the

firm's collateral, profitability, and return volatility as firms with a higher risk on average find it difficult to access credit. We use cross-listing, board gender diversity, and executive gender diversity to capture the effect of firm geographic diversity and gender diversity at the top management levels. Diversity appears to improve firms' access to critical resources, including finance.

To mitigate any potential confounding effect of CSR, we include the governance pillar score and the community score which are often used in constructing ESG scores. Firms with better CSR disclosures face lower capital constraints (Cheng *et al.*, 2014). Finally, we control for a country's level of development and its openness by including GDP growth and GDP per capita. To mitigate the impact of outliers on our regression estimates, we winsorize all continuous variables at the 1% level. We define all our variables in Appendix A. It is important to highlight that our primary interest is in the parameter estimates (β_2) for the environmental performance (*EP*) variables in Eq. (1). If these parameter estimates turn out to be negative and statistically significant, they will then provide empirical evidence to support our baseline hypothesis (H1). We turn to the empirical analysis in the next section.

3.3 Key variable definitions

3.3.1 Financial constraint

The degree of financial constraints faced by a firm relates to its inability to access financing at a lower cost (Gamba and Triantis, 2008). At the basic level, financial constraints relate to the extent to which a firm lacks financial resources. Following Choi, Ju, Trigeorgis, and Zhang (2021), we primarily use the KZ index to measure a firm's level of financial constraint. Kaplan and Zingales (1997) provide a structural approach to financial constraint and develop an index of firm characteristics that are related to a firm being financially constrained. The KZ index is based on five accounting-related measures: cash flow, market value, debt, dividend, and cash holding. The KZ index loads positively on market-to-book and leverage ratios, and negatively on cash flow, dividend, and cash holdings. Specifically, we follow the following specification in Eq. (1) to estimate the KZ index:

$$KZ = -1.002 \times \left(\frac{CF_t}{TA_{t-1}}\right) + 0.283 \times \left(\frac{MV_t}{TA_{t-1}}\right) + 3.139 \times \left(\frac{TD_t}{TA_{t-1}}\right) - 39.368 \times \left(\frac{D_t}{TA_{t-1}}\right) - 1.315 \times \left(\frac{C_t}{TA_{t-1}}\right) \quad \text{Eq. (2)}$$

where *CF* is cash flow, *MV* is market value of the firm, *TD* is total debt, *D* is dividend, *C* is the cash balance, *TA* is total assets,[10] *t* is the current year and *t-1* is the previous year.

The KZ index has the advantage of using the unique information contained in each of the five firm attributes of financial constraints. This notwithstanding, we also use the WW index as an alternative measure of financial constraint to test the robustness of our baseline results. The WW index is based on six variables and can be calculated using the following formula from Whited and Wu (2006):

$$WW = -0.091 \times \left(\frac{CF_t}{TA_{t-1}}\right) - 0.062 \times (Div_t) + 0.021 \times \left(\frac{LTD_t}{TA_{t-1}}\right) - 0.044 \times ln(TA_t) + 0.102 \times (ISG_t) - 0.035 \times (SG_t) \quad \text{Eq. (3)}$$

where all variables remain as previously defined except a dummy for firms paying cash dividend (*Div*), long-term debt (*LTD*), industry sales growth (*ISG*) and firm sales growth (*SG*).

A higher value of KZ index or WW index implies that a firm is more financially constrained. Several studies on financial constraints including Balafas and Kostakis (2017), Cheng *et al.* (2014), Livdan *et al.* (2009), Meng *et al.* (2020), Chen *et al.* (2021) and Williamson and Yang (2021) use the KZ or WW as one of their financial constraint indices.

3.3.2 Environmental performance

We follow prior studies such as Cheng *et al.* (2014), Gallego-Alvarez and Pucheta-Martínez (2020) Desender and Epure (2021) in relying on Thomson Reuters ESG database (previously Datastream ASSET4) for our measures of environmental performance. To ensure robust analysis and to explore different dimensions of corporate environmental performance, we utilise two proxies: (i) overall environmental score (ENV_SCORE); and (ii) environmental emission score (EMI_SCORE). Although the two proxies are

[10]Since total asset is prominent in the KZ index, in untabulated analysis, we drop control variables that are related to total assets. In other analysis, we use sales instead total assets to construct variables that relied on total assets. In both analyses, the main results and conclusions of the study remain qualitatively unchanged.

related, each variable reflects the construct from a different perspective. First, the overall environmental score (ENV_SCORE) measures the firm's *impact on living and non-living natural systems, including the air, land, and water, as well as the complete ecosystem. It reflects how well a firm uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long-term shareholder value*.

The second proxy for environmental performance – environmental emission score (EMI_SCORE) – measures the *commitment and effectiveness of the firm's management towards reducing environmental emissions in the production and operational processes*. Specifically, this measure reflects a firm's capacity to reduce air emissions (i.e., greenhouse gases such as CO_2, F-gases, ozone-depleting substances), hazardous waste, spills or its impact on biodiversity, and to partner with environmental organizations to reduce the environmental impact of the company in the community. Whereas ENV_SCORE is a broader measure of the firm's environmental performance, the EMI_SCORE focuses on gas emissions – a specific but arguably topmost area of environmental concern for environmental stakeholders. Higher values of both measures of environmental performance (ENV_SCORE and EMI_SCORE) are indicative of better environmental performance and reflect environmentally responsible corporate practices.

4. Findings and discussions

4.1 Descriptive statistics

Table 2 presents the descriptive statistics for the full sample and for subsamples of firms in high carbon-emitting countries vis-à-vis those in low carbon-emitting countries. A few observations are worth noting. The mean value for our primary measure of financial constraint (KZ index) is -1.024 and the standard deviation is 2.461, suggesting significant variations across firms regarding the degree of financial constraints they face. The level of financial constraint (KZ index) is significantly higher in high carbon-emitting countries than in low carbon-emitting countries. Perhaps, stakeholders are withholding financial resources from firms in high carbon-emitting countries to pressurise them to operate sustainably. It appears

firms in high carbon-emitting countries respond to this pressure since they have better environmental performance scores (ENV_SCORE and EMI_SCORE) than their counterparts in low carbon-emitting countries. Further, it seems the increased environmental pressure on high carbon-emitting countries comes from foreign investors since their firms have a higher proportion of cross-listed firms (22.3% vs. 6.7%).

We present the correlation matrix for all the variables of interest in Table 3. KZ index is significantly negatively correlated with ENV_SCORE but not significantly correlated with EMI_SCORE. The correlations among our variables are generally low – often less than 0.4. There are a few exceptions though. There is high correlation of 0.901 between ENV_SCORE and EMI_SCORE but this should not cause any multicollinearity concerns because they are alternative measures of environmental performance which do not enter the empirical models simultaneously. The other relatively high correlation coefficients range from 0.40 to 0.55 and relate to the correlations among our environmental performance measures (ENV_SCORE and EMI_SCORE) and the other CSR measures relating to governance (GOV_SCORE) and community (COM_SCORE). This high correlation between environmental performance and the other CSR dimensions is consistent with recent findings in Lopatta et al. (2020). The baseline results remain qualitatively unchanged when the regressions are estimated with or without the CSR variables (GOV_SCORE and COM_SCORE).

[PLEASE INSERT TABLE 2 HERE]

[PLEASE INSERT TABLE 3 HERE]

4.2 Baseline results

We present the baseline results of Eq. (1) in Table 4. In these results, financial constraint is measured as the KZ index. In estimating the regressions in Eq. (1), Models 1 and 3 of Table 4 use the overall environmental score (ENV_SCORE) to measure environmental performance, while Models 2 and 4 use environmental emission score (EMI_SCORE).

In Model 1, the coefficient on ENV_SCORE is negative and highly significant (β_2 = -0.0099; *p-value* = 0.000) at the 1% level, suggesting that firms with better environmental performance are associated with significantly lower levels of financial constraints. This finding is economically significant and implies that an average firm that improves its overall environmental performance by one standard deviation can reduce its levels of financial constraints by 26%.[11] In Model 2, we focus on firms' commitment to a specific environmental problem – i.e., emissions – by replacing ENV_SCORE with EMI_SCORE and re-running Eq. (1). As can be seen, although the magnitude of the negative coefficient for environmental performance in Model 2 drops, it remains negatively and highly significant (β_2 = -0.0055; *p-value* = 0.003). This indicates that firms can enjoy an average of about 17% reductions in their levels of financial constraints when they improve their environmental emission performance by one standard deviation. Overall, these results are consistent with our constraint alleviation hypothesis. Taken together, our results underscore the relative importance of environmental emissions in the sustainability agenda – since over 65% of our estimated economic gains associated with environmental performance is from reducing environmental emissions.

In Models 3 and 4, we repeat the analysis in Models 1 and 2 but include firm-fixed effect in Eq. (1) in addition to year-fixed effects. In Model 3, the coefficient of ENV_SCORE remains negative and significant at the 5% level. However, EMI_SCORE becomes statistically insignificant in Model 4. These results suggest that while our earlier finding regarding overall environmental performance (ENV_SCORE) is robust to the inclusion of firm-fixed effects, that of the environmental emission (EMI_SCORE) is sensitive to firm-fixed effects. Meanwhile, Chava (2014) argues that environmental variables tend to be persistent over time, so models without firm-fixed effects are more appropriate. Therefore, we draw our main conclusions based on the baseline results in Models 1 and 2.

[11]This is calculated as: (-0.0099 x 26.393) / -1.024; where -0.0099 is the coefficient estimate of ENV_SCORE; 26.393 is the standard deviation of ENV_SCORE; and -1.024 is the average KZ index.

The coefficients of control variables are generally consistent with expectations. Although governance, management gender diversity, and GDP growth have the expected negative signs, they are not significant. Community responsibility, firm age, asset growth, profitability, board gender diversity, and GDP per capita have the expected negative impact on financial constraints, while volatility and growth opportunities impact financial constraints positively. The effect of the other control variables including firm size, collateral, cross-listing, and industry concentration is not consistent with expectations.

[PLEASE INSERT TABLE 4 HERE]

The KZ measure of financial constraints used in Table 4 is not perfect and may fail to adequately capture aspects of financial constraints (Almeida, Campello, and Weisbach, 2004). To make our tests more robust, we use an alternative measure of financial constraint, the WW index, to re-run the earlier results. The results based on the WW index are reported in Table 5. In all the regressions, the coefficients of ENV_SCORE and EMI_SCORE (our measures of environmental performance) are negative and highly significant. In fact, the coefficients of interest remain negative and significant after controlling for firm-fixed effect in Models 3 and 4 of Table 5. Consistent with the constraint alleviation hypothesis, these results suggest that firms with better environmental performance and good emission records may have better access to finance, and thus, face lower levels of financial constraint.

[PLEASE INSERT TABLE 5 HERE]

4.3 Further robustness tests

4.3.1 Generalisability of results across countries

We noted in Section 3.1 that our sample is drawn from 24 emerging market countries, and five of these countries alone contribute almost 60% to the firms in the sample. Therefore, we test whether our main finding is driven by the firms from the over-represented countries of Taiwan, South Africa, India, China, and Brazil. The results for this analysis are presented in Section 1 of the Online Appendix. In Model 1, we estimate the baseline regression in Eq. (1) with the full sample excluding Taiwan – the country with the

highest representation of firms. The coefficient of ENV_SCORE is negative (β_2 = -0.0099) and significant at 1% level. Models 2, 3, 4, and 5 sequentially remove the countries with the second (South Africa), third (India), fourth (China) and fifth (Brazil) highest sample representations and re-run the baseline regression. The results indicate that the coefficient of ENV_SCORE remains negative (with β_2 ranging from -0.0073 to -0.0099) and highly significant across all the models using different combinations of the sample. The results in Model 5 suggest that our finding of financial constraint being significantly lower for firms with superior environmental performance continues to hold for the remaining 40% of the sample from 19 emerging market countries (i.e., without the top five countries).

Finally, we show in Model 6 that the baseline result of a negative relationship between environmental performance and financial constraint is not only present but is strongest in the five countries with the highest representation. The magnitude of the coefficient of ENV_SCORE is larger (β_2= -0.0108) and significant at the 1% level. This indicates that our results may better fit firms from the emerging markets of Taiwan, South Africa, India, China, and Brazil. In untabulated results, we find similar results when we repeat the analysis for our environmental emission score (EMI_SCORE) measure of environmental performance.[12]

4.3.2 Addressing endogeneity concerns

A crucial challenge in the empirical analysis is endogeneity bias, which may prevent us from drawing causal inferences from our results. To mitigate endogeneity concerns emanating from omitted variables, we have attempted to control for several firm-, industry-, and country-level variables, as well as country-, industry-, year-fixed, and sometimes firm-fixed effects. However, there could still be endogeneity concerns relating to reverse causality, especially when evidence suggests that financial constraints impact corporate goodness by limiting firms' spending on socially responsible activities (Kubik, Scheinkman and Hong,

[12]Countries such as Czech Republic, Greece, Hungary, and Poland are in the European Union (EU) and may thus be influenced by EU environmental regulations. Our results are qualitatively the same when we exclude these countries from the sample. Also, our results remain unchanged when we exclude Pakistan which has limited observation. These results are available upon request, and we are grateful to a reviewer who suggested these analyses.

2011) and environmentally-friendly innovations (Xu and Kim, 2021). Similarly, Tian and Lin (2019) find that moderate and major financing obstacles are closely related to worse environmental performance.

We attempt to mitigate this concern by estimating an instrumental variable (IV) regression in which our independent variable [environmental performance is assumed to be endogenous and is therefore instrumented by *Democracy Index (DI)*]. Our DI variable is obtained from the Global Democracy Index database from The Economist.[13] Our choice of *DI* as an instrument is influenced by studies such as Cheung (2016), Di, Giuli, and Kostovetsky (2014) and Deng, Kang and Low (2013) that suggest that democratic ideologies tend to be associated with high environmental awareness. Thus, we expect *DI* to be highly correlated with environmental performance but not financial constraint. In Models 1-2 of Table 6, the results are based on using the 2020 values for *DI* to preserve our sample and to reflect more recent sentiments on democracy (and/or environmental issues). However, since this instrument is time-invariant, we are unable to control for country-fixed effect, which makes omitted variable problems more likely. We attempt to mitigate these concerns in Models 3-4 by utilising a time-variant *DI* as the instrument and control for country-fixed effect. Since data on *DI* starts from 2006, we lose our pre-2006 observations in this time-variant analysis.

As reported in Models 1 and 3 of Table 6, the *DI* variable is significantly and positively related to environmental performance, irrespective of whether the time-invariant or time-variant *DI* variable is used. This suggests that more democratic nations tend to be more environmentally sensitive. Further, in Models 2 and 4, the diagnostic statistics from our IV regressions (Durbin and Wu-Hausman tests) suggest that our instrument (*DI*) is exogenous, and, therefore, valid. Importantly, our baseline finding of a negative and significant relationship between environmental performance and financial constraint remains qualitatively unchanged in both Models 2 and 4. Finally, our baseline finding remains qualitatively unchanged when we re-specify our model to allow for a lag between the dependent variable and the independent (and control)

[13]See: https://www.economist.com/graphic-detail/2021/02/02/global-democracy-has-a-very-bad-year for information on the democracy index [Accessed on 15 June 2022].

variables, as shown in Model 5 of Table 6. Overall, it seems that our baseline results and conclusion that implementing environmentally responsible practices could help firms to mitigate their levels of financial constraints are robust to endogeneity (reverse causality) concerns.

[PLEASE INSERT TABLE 6 HERE]

4.4 Further analyses

4.4.1 Are the baseline results more pronounced for firms in high carbon-emitting countries?

If, indeed, investors and other key stakeholders of the firm use their influence to get firms to behave in an environmentally responsible manner, then we will expect them to exert greater pressure and/or offer stronger incentives in countries with severe environmental problems. Given the rising carbon emissions in emerging markets (see Fig. 1), environmental stakeholders such as institutional investors managing ethical/responsible funds may deploy their influence more in high carbon-emitting countries. In that case, engaging in environmentally responsible practices may be more advantageous (i.e., offer easier access to financing) to firms in high carbon-emitting countries than to their counterparts elsewhere.

We empirically test this conjecture by modifying the baseline regression in Eq. (1) to include an interaction term of either ENV_SCORE or EMI_SCORE and HIGH_EMISSION, where HIGH_EMISSION is an indicator variable equal to 1 if a country contributed at least 1% to global CO_2 emissions in 2017, and 0 otherwise. The high-emitting countries in our sample are China, India, Russia, Indonesia, Brazil, South Africa, and Turkey. These countries alone contributed over 40% to global CO_2 emission in 2017 while emissions by the remaining sample countries was less than 10%. Thus, it is likely that world leaders and institutional investors concerned about the environment will use their influence more in these high carbon-emitting emerging markets to get them to adopt low carbon technologies. For example, firms in these high carbon-emitting countries that commit to environmental sustainability can easily obtain financing to support low carbon innovations and projects.

The results of this test are displayed in Models 1 and 2 of Table 7. The interaction terms of both measures of environmental performance (ENV_SCORE or EMI_SCORE) and HIGH_EMISSION are negative and statistically significant, suggesting that firms in the high carbon-emitting countries that implement good environmental practices enjoy significantly lower levels of financial constraints than their counterparts in low carbon-emitting countries. These results imply that relative to other firms, the firms in high carbon-emitting countries have stronger market incentives to engage in environmentally responsible practices.

[PLEASE INSERT TABLE 7 HERE]

4.4.2 Are the baseline results more pronounced in countries that adopted the Paris Agreement early?

Since its adoption on 12th December 2015, the Paris Agreement has been a major global framework for addressing climate change and its negative impacts. Therefore, the Paris Agreement may represent a huge source of global political pressure for governments, investors, and managers to take action to tackle climate change. Although the Paris Agreement was adopted in late 2015, it did not take effect until 4th November 2016 after at least 55 nations representing at least 55% of global emissions had joined. This meant that there was immense global political pressure on high carbon-emitting countries, including several emerging market countries, to join the Paris Agreement. The Paris Agreement also offered some incentives for developing countries to join since it encouraged developed countries to provide financial resources to developing countries to help them reduce emissions and adapt to the impacts of climate change.[14]

Arguably, the countries that adopted the Paris Agreement in 2016 or earlier may represent the high carbon-emitting countries that faced relatively greater external pressure to take environmental action. We refer to such countries as "early Paris Agreement adopters" and examine whether their firms enjoy

[14]The 32-page Paris Agreement document can be assessed from here https://s3.documentcloud.org/documents/2646274/Updated-l09r01.pdf [Accessed on 09/09/21].

significantly lower levels of financial constraints relative to the firms in countries that either adopted the agreement late or never adopted it. To implement this test, we create an indicator variable, EARLY_PARIS, which is equal to 1 for the firms in countries classified as "early Paris Agreement adopters", and 0 otherwise. Except for Chile, Columbia, Czech Republic, Egypt, Kuwait, Philippines, Qatar, Russia, Taiwan, and Turkey, all our sample countries were classed as "early Paris Agreement adopters".

After creating the EARLY_PARIS indicator variable, we interacted it with our measures of environmental performance (ENV_SCORE or EMI_SCORE) and included the interaction terms in the baseline regression. The regression results are reported in Models 3 and 4 of Table 7. As expected, the coefficients for both interaction terms (ENV_SCORE x EARLY_PARIS and EMI_SCORE x EARLY_PARIS) are negative and significant. These findings support our contention that firms in countries that are likely to face high global political pressure to take climate action face significantly lower levels of financial constraints when they embrace environmental sustainability. It seems that the supply of financial resources is one of the tools used by global powers to press firms to embrace environmental responsibility.

4.4.3 Are the baseline results more pronounced for cross-listed firms?

Due to institutional voids such as weaker governance and legal structures and the underdevelopment of capital markets in emerging markets, some large firms may not be able to source the needed finance from domestic markets and may, thus, be forced to seek financing abroad. Chen *et al.* (2021) reports that non-US firms facing higher levels of financial constraints are more likely to cross-list on US stock exchanges, and when they do, they are able to significantly reduce their financial constraints.

Accordingly, emerging market firms that require capital are likely to cross-list on foreign stock exchanges, especially those in advanced countries. However, unlike domestic investors in emerging markets, institutional investors in foreign (advanced) countries are more likely to have environmental concerns (Hartmann and Uhlenbruck, 2015) and therefore likely to press emerging market firms to engage in environmentally friendly practices. In fact, a significant proportion of the cross-listed firms in our sample

are based in high carbon-emitting countries (see Table 2) and may need to demonstrate strong commitments to environmental sustainability in order to access international capital markets. Ko *et al.* (2021) show that foreign institutional pressures influence Chinese firms' environmental strategy and their international activities. Based on these insights, the negative association between environmental performance and financial constraint may be stronger for these emerging market firms that cross-list since they are likely to face intense global pressure for climate action.

Similar to the other analysis in this subsection, we test this proposition by interacting our environmental performance measures with our indicator variable for cross-listed firms (ENV_SCORE x CROSS_LISTED and EMI_SCORE x CROSS_LISTED).[15] The results are presented in Models 5 and 6 of Table 7 and show that although the coefficient for ENV_SCORE x CROSS_LISTED is negative, it is not statistically significant at conventional levels. However, the coefficient for EMI_SCORE x CROSS_LISTED is negative and highly significant, suggesting that emerging market firms with better carbon records benefit from improved access to financing when they cross-list on foreign stock exchanges.

4.4.4 Are investors more concerned about the environment than other aspects of CSR?

While environmental responsibility forms part of the broader concept of CSR, environmental concerns seem to disproportionately obtain more attention from policy makers, academics, and practitioners. This may partly be due to the link between climate change risk and environmental sustainability. We utilize our existing empirical framework to explore the relative importance of the major elements of CSR to investors. We conduct this analysis by comparing the magnitude of the benefits (i.e., the extent of financial constraint reductions) obtained when firms invest in specific aspects of CSR.

Section 2 of the Online Appendix presents these results. In Model 1, we consider a firm that focuses its entire CSR efforts on the environment and find that ENV_SCORE is negative and significant, implying

[15]More than 10% of our sample firms are cross-listed on major stock exchanges in the US, UK, Germany, France, Australia, among others.

that a firm that commits its CSR budget solely to environmental matters may reduce its levels of financial constraints by an average of 30%. In Model 2, we control for social score (SOC_SCORE) to capture the social dimensions of the firm's CSR activities. Here, both the coefficients of ENV_SCORE and SOC_SCORE are negative and significant at the 1% levels but the magnitude of the coefficient of ENV_SCORE (β_i = -0.0073) is larger than that of SOC_SCORE (β_i = -0.0068). This suggests that while the environmental aspects of a firm's CSR efforts may reduce its financial constraints by about 18.8%, its social CSR efforts mitigate financial constraints by a lower magnitude of 17.5%.

Next, we consider a firm that spreads its CSR efforts between the environment (ENV_SCORE) and the community (COM_SCORE) and again find the environmental effect to dominate (see Model 3). In Model 3, the results imply that environmental efforts reduce financial constraints by 26%, on average, but CSR activities that are community-oriented only reduce financial constraints by an average of 9%. Similar results are obtained in Model 4 when we instead include a control variable for governance (GOV_SCORE). As in the prior results, the impact of environmental score is greater than that of governance score. Specifically, while environmental efforts reduce financial constraints by 29%, governance efforts only reduce financial constraints by 4%. The results remain qualitatively unchanged even when we control for CSR – the composite variable (see Model 5). Finally, we include all the major dimensions of CSR in a single regression in Model 5, while they are all negatively related to financial constraints, only ENV_SCORE and SOC_SCORE retain their statistical significance at conventional levels. Further, the effect of ENV_SCORE continues to dominate, suggesting that corporate stakeholders, particularly investors prioritise environmental concerns over other aspects of the firm's CSR activities.

5. Conclusion

In this paper, we examine whether corporate environmental performance affects the firms' levels of financial constraints. We draw from the stakeholder and legitimacy theoretical frameworks to argue that to the extent that environmental protection and climate action are global societal values cherished by key

organizational stakeholders such as investors, customers, and governments, then corporate response to environmental concerns could present a competitive advantage and unleash economic benefits such as mitigating financial constraints.

Our results, based on a sample of over 8,500 firm-years from 24 emerging market countries during 2003-2020, indicate that better environmental performance is associated with significantly lower levels of financial constraints. This finding denotes that environmental performance could be a source of value to firms because they obtain environmental legitimacy to obtain cheaper and easier access to capital when the firms commit to environmental responsibility. A closer look at the results suggests that much of the gains from environmental performance are related to having a good record of environmental emissions.

Furthermore, we document that the advantage of reduced financial constraints associated with environmental performance is not symmetric across countries (operating environments) and firms. Firms in high carbon-emitting countries seem to reap significantly high reductions in their levels of financial constraints when they improve their environmental performance than their counterparts in low carbon-emitting countries. We also report significantly larger reductions in financial constraints for firms located in countries that adopted the 2015 Paris Agreement on climate change early. Next, we find that the reductions in financial constraints associated with environmental performance were significantly higher for firms that cross-list on foreign stock exchanges. These results imply that key organizational stakeholders such as investors offer stronger incentives to firms to engage in environmentally responsible practices when environmental degradation is acute to become a major national/international concern. Finally, we report that the environmental dimension of CSR delivers greater reductions in financial constraints than any of the other CSR dimensions that are oriented towards the social, community or governance activities. This suggests that environmental concerns rank higher in priority for investors than the other CSR dimensions. Collectively, our results suggest that *where* stakeholders of the firm are likely to exert pressure and call for action on mitigating environmental degradation, firms do enjoy economic gains in the form of reduced financial constraints when they act responsibly towards the environment.

Our study contributes to an emerging literature that links environmental concerns to capital markets (Cai *et al.*, 2016; El Ghoul *et al.*, 2018; Weber *et al.*, 2010) and highlights the role of capital markets in evaluating the long-term value creation by emerging market firms that adopt environmentally friendly strategies. An important role of capital markets is to allocate scarce financial resources to the most productive uses, and this study demonstrates that environmental performance plays a significant role in the capital allocation process. That is, investors are more willing to allocate scarce capital resources to firms that better engage with environmental sustainability. Moreover, by extending the analysis to explore the influence of country-level carbon emissions, early adoption of the 2015 Paris Climate Agreement, and the cross-listing status of firms, we are able to show *where* and *under what conditions* environmental performance may deliver the largest reductions in financial constraints. In addition, we provide evidence to show the relative importance of environmental performance in the firm's CSR efforts. Finally, we contribute to the literature on financial constraints (see Cheng *et al.*, 2014; Balafas and Kostakis, 2017; Erel *et al.*, 2015) by highlighting that environmental performance may be a significant determinant of financial constraints in emerging markets, thus, identifying a firm-level characteristic that is linked to the degree of financial constraints that emerging market firms face.

Despite the important contributions made by our study, our analysis and conclusions are based on emerging market firms. Thus, interpretation and application of the results, particularly in the context of developed markets, should be undertaken with caution. Future studies can extend this research by employing a global sample to examine the applicability of the findings outside emerging markets. Similarly, and like all studies based on archival data, our proxies for corporate environmental performance and financial constraints, among others, may not reflect practice. In particular, our choice of instruments to implement our two-stage least squares regressions to address endogeneity concerns may not be perfect. Therefore, future studies may conduct in-depth interviews and case studies among directors, managers, and investors regarding these issues.

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Disclosure statement

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Fig. 1 – Global carbon emissions

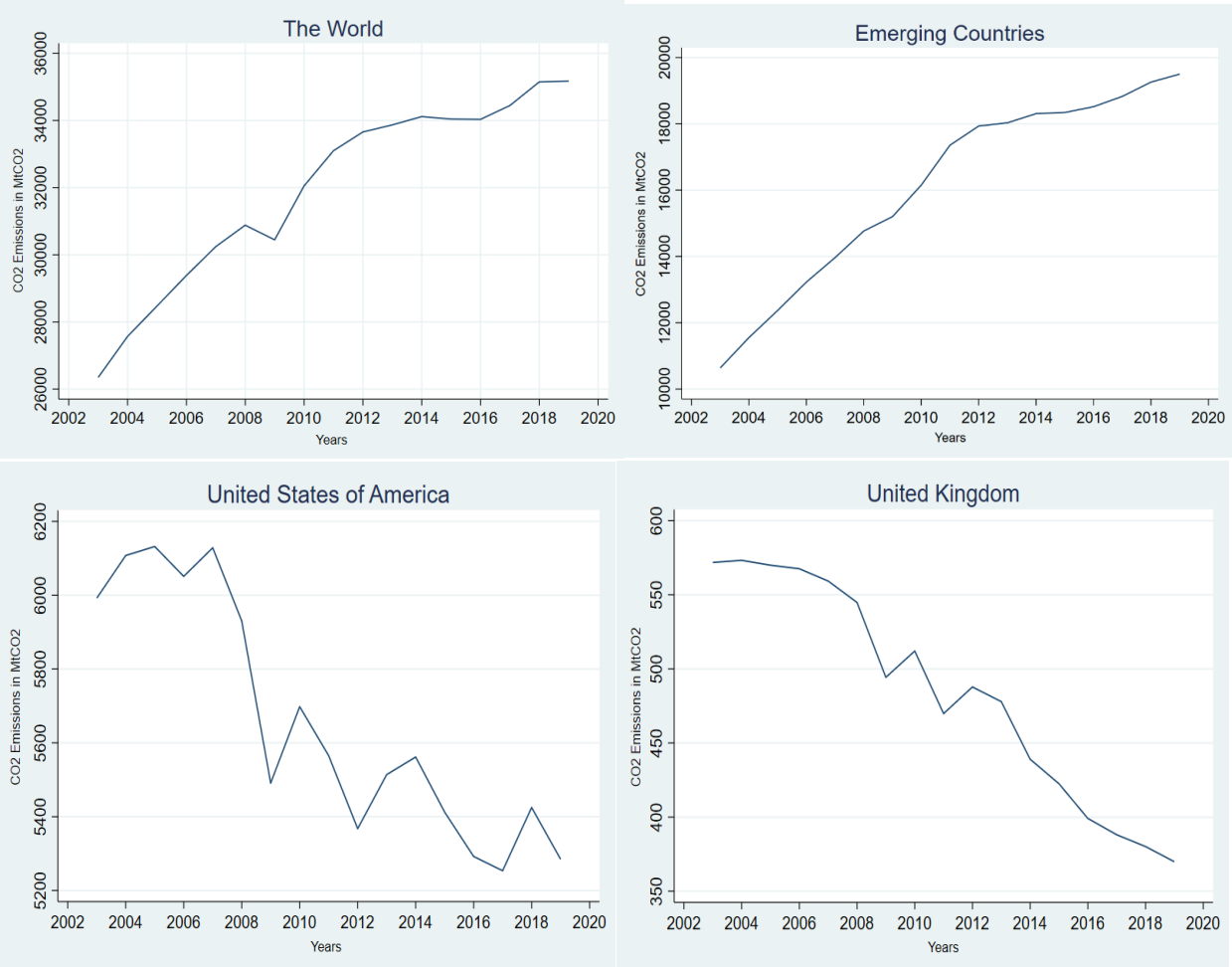

Fig. 1: Recent trends in global CO_2 emissions, and in emerging economies and selected advanced economies. Data is from the Global Carbon Atlas: http://www.globalcarbonatlas.org/en/CO2-emissions

Table 4: The effect of environmental performance on financial constraint (measured by the KZ index)

Model	(1)	(2)	(3)	(4)
Dependent variable	KZ	KZ	KZ	KZ
ENV_SCORE	-0.0099***		-0.0028**	
	(0.0010)		(0.0013)	
EMI_SCORE		-0.0055***		0.0000
		(0.0009)		(0.0011)
COM_SCORE	-0.0031***	-0.0042***	-0.0022**	-0.0027***
	(0.0008)	(0.0008)	(0.0010)	(0.0010)
GOV_SCORE	-0.0007	-0.0015	0.0003	-0.0002
	(0.0009)	(0.0010)	(0.0013)	(0.0013)
SIZE	0.4295***	0.4158***	0.5853***	0.5722***
	(0.0247)	(0.0253)	(0.0914)	(0.0904)
AGE	-0.0042*	-0.0052**	-0.0176	-0.0195
	(0.0023)	(0.0023)	(0.0152)	(0.0153)

TOBIN'S Q	0.5682***	0.5055***	0.2118	0.2409
	(0.1463)	(0.1554)	(0.3521)	(0.3489)
TA_GROWTH	-0.0074	-0.0020	-0.3210***	-0.3181***
	(0.1257)	(0.1270)	(0.0671)	(0.0671)
COLLATERAL	0.7198***	0.6948***	0.9135***	0.9178***
	(0.0869)	(0.0873)	(0.2914)	(0.2918)
ROA	-0.1936***	-0.1942***	-0.1009***	-0.1010***
	(0.0055)	(0.0055)	(0.0053)	(0.0053)
RETURN_VOLATILITY	-0.0062	-0.0051	3.0340***	2.9869***
	(0.0082)	(0.0083)	(0.8551)	(0.8556)
BOD_GEN_DIVERSITY	-0.0016	-0.0015	-0.0046*	-0.0045
	(0.0021)	(0.0021)	(0.0027)	(0.0027)
MGT_GEN_DIVERSITY	-0.0027	-0.0028	0.0025	0.0027
	(0.0018)	(0.0018)	(0.0028)	(0.0028)
CROSS-LISTED	0.1148*	0.1112*	-0.3393	-0.2708
	(0.0654)	(0.0654)	(0.4639)	(0.4627)
IND_CONCENTRATION	-0.0079	0.1308	2.1379**	2.1258**
	(1.0777)	(1.0805)	(0.9124)	(0.9142)
GDP_GROWTH	-0.0026	-0.0031	-0.0017	-0.0015
	(0.0108)	(0.0108)	(0.0086)	(0.0086)
GDP_PER_CAPITA	-0.8578***	-0.8665***	-1.0720***	-1.0910***
	(0.1567)	(0.1574)	(0.1631)	(0.1645)
CONSTANT	1.8317	2.1843	2.2825	2.8459*
	(1.6466)	(1.6635)	(1.7093)	(1.7147)
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	Yes	Yes	No	No
INDUSTRY FIXED EFFECT	Yes	Yes	No	No
FIRM FIXED EFFECT	No	No	Yes	Yes
Observations	8,581	8,581	8,581	8,581
Adjusted R-squared	0.5129	0.5099	0.7636	0.7635

This table presents results of the relations between environmental performance and financial constraints based on the standard OLS model. The dependent variable is the KZ index. We control for industry-, year-, and country-fixed effects in Models 1 and 2 and control for firm-, and year-fixed effects in Models 3 and 4. Variables are defined in Appendix A. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively

Table 5: The effect of environmental performance on financial constraint (measured by the WW index)

Model	(1)	(2)	(3)	(4)
Dependent variable	WW	WW	WW	WW
ENV_SCORE	-0.0001***		-0.0002***	
	(0.0000)		(0.0001)	
EMI_SCORE		-0.0001***		-0.0001**
		(0.0000)		(0.0000)
COM_SCORE	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GOV_SCORE	0.0000	-0.0000	0.0000	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
SIZE	-0.0261***	-0.0262***	-0.0142***	-0.0144***
	(0.0015)	(0.0016)	(0.0037)	(0.0037)
AGE	-0.0004*	-0.0004*	-0.0020***	-0.0020***
	(0.0002)	(0.0002)	(0.0008)	(0.0008)

TOBIN'S Q	0.0184***	0.0177***	-0.0094*	-0.0086
	(0.0040)	(0.0040)	(0.0057)	(0.0057)
TA_GROWTH	-0.0389*	-0.0389*	-0.0365***	-0.0364***
	(0.0206)	(0.0206)	(0.0131)	(0.0131)
COLLATERAL	0.0119	0.0118	-0.0133	-0.0130
	(0.0073)	(0.0075)	(0.0135)	(0.0135)
ROA	-0.0014***	-0.0014***	-0.0007**	-0.0007**
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
RETURN_VOLATILITY	-0.0002	-0.0001	0.1080*	0.1062*
	(0.0004)	(0.0004)	(0.0637)	(0.0636)
BOD_GEN_DIVERSITY	-0.0003***	-0.0003***	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
MGT_GEN_DIVERSITY	0.0002	0.0002	-0.0000	-0.0000
	(0.0002)	(0.0002)	(0.0001)	(0.0001)
CROSS-LISTED	-0.0014	-0.0015	-0.0150	-0.0146
	(0.0020)	(0.0020)	(0.0140)	(0.0141)
IND_CONCENTRATION	0.0323	0.0348	0.0717**	0.0730**
	(0.0356)	(0.0356)	(0.0321)	(0.0320)
GDP_GROWTH	0.0004	0.0003	0.0004	0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
GDP_PER_CAPITA	0.0196***	0.0195***	0.0153***	0.0150***
	(0.0052)	(0.0052)	(0.0048)	(0.0048)
CONSTANT	-0.2675***	-0.2646***	-0.2727***	-0.2601***
	(0.0531)	(0.0533)	(0.0596)	(0.0588)
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	Yes	Yes	No	No
INDUSTRY FIXED EFFECT	Yes	Yes	No	No
FIRM FIXED EFFECT	No	No	Yes	Yes
Observations	8,580	8,580	8,580	8,580
Adjusted R-squared	0.1460	0.1458	0.5018	0.5017

This table presents results of the relations between environmental performance and financial constraints based on standard OLS regressions. The dependent variable is the WW index. We control for industry-, year-, and country-fixed effects in Models 1 and 2 and control for firm-, and year-fixed effects in Models 3 and 4. Variables are defined in Appendix A. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Table 6: Further tests to address endogeneity concerns

Model	(1)	(2)	(3)	(4)	(5)
Description	IV regression – using a time invariant (DI) instrument		IV regression – using a time variant (DI) instrument		Lagged effect analysis
	1st Stage	2nd Stage	1st Stage	2nd Stage	
Dependent variable	ENV_SCORE	KZ	ENV_SCORE	KZ	F.KZ
DEM_INDEX	2.4903***		1.8791*		
	(0.1542)		(1.0079)		
ENV_SCORE		-0.0144***		-0.1365**	-0.0091***
		(0.0051)		(0.0570)	(0.0010)
COM_SCORE	0.3057***	-0.0017	0.2116***	0.0242**	-0.0022***
	(0.0083)	(0.0018)	(0.0092)	(0.0121)	(0.0008)
GOV_SCORE	0.2317***	0.0008	0.1614***	0.0217**	-0.0004
	(0.1044)	(0.0015)	(0.0116)	(0.0092)	(0.0009)
SIZE	5.1537***	0.4521***	5.4130***	0.9766***	0.4110***

	(0.1955)	(0.0305)	(0.4021)	(0.3115)	(0.0245)
AGE	0.2062***	-0.0062**	0.2283***	0.0127	-0.0058**
	(0.0245)	(0.0025)	(0.0719)	(0.0141)	(0.0024)
TOBIN'S Q	13.1459***	0.6451***	-3.2922	-357.1531***	0.5407***
	(3.2156)	(0.1445)	(148.7243)	(14.8671)	(0.1403)
TA_GROWTH	-1.5632***	0.0171	-2.2297***	-0.6146***	0.4966***
	(0.4384)	(0.1315)	(0.5306)	(0.1375)	(0.1677)
COLLATERAL	11.2525***	0.7671***	1.0934	0.8088***	0.6384***
	(0.9691)	(0.0960)	(1.6378)	(0.1668)	(0.0851)
ROA	0.1295***	-0.1920***	0.0322	-0.0794***	-0.1969***
	(0.0266)	(0.0054)	(0.0275)	(0.0035)	(0.0056)
RETURN_VOLATILITY	-0.2785***	-0.0049	-0.2288	-0.0309	0.0104
	(0.4383)	(0.0079)	(0.3175)	(0.0303)	(0.0068)
BOD_GEN_DIVERSITY	0.0349*	-0.0019	-0.0700***	-0.0144***	-0.0009
	(0.0206)	(0.0020)	(0.0234)	(0.0047)	(0.0021)
MGT_GEN_DIVERSITY	-0.0669***	-0.0049***	-0.0334	-0.0022	-0.0011
	(0.0173)	(0.0016)	(0.0213)	(0.0028)	(0.0019)
CROSS-LISTED	1.3686**	0.0873	4.4215**	0.6773**	0.0600
	(0.6552)	(0.0599)	(2.2069)	(0.3054)	(0.0675)
IND_CONCENTRATION	14.4768	0.0189	9.5887	2.9000***	0.6215
	(11.6357)	(1.0953)	(7.8483)	(1.0335)	(1.1351)
GDP_GROWTH	-0.3984***	-0.0306***	-0.1230	-0.0211*	-0.0117
	(0.0859)	(0.0086)	(0.0781)	(0.0108)	(0.0114)
GDP_PER_CAPITA	0.8362***	-0.3647***	5.8046***	0.3631	-0.8026***
	(0.2717)	(0.0256)	(1.2078)	(0.3626)	(0.1624)
CONSTANT	-116.5083***	-2.8063***	-170.6872***	-21.2944**	1.3829
	(7.2486)	(0.6697)	(16.3841)	(9.1440)	(1.6793)
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	No	No	Yes	Yes	Yes
INDUSTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes
Observations	8,581	8,581	5,770	5,754	8,158
Adjusted R-squared	0.4636	0.5026	0.4910	0.5135	0.5182
Durbin test		0.289		0.8102	N/A
Wu-Hausman test		0.291		0.8146	N/A

This table presents results of the relations between environmental performance and financial constraints based on IV regression procedures in Models 1-4. Democracy index (DEM_INDEX) is used as the instrumental variable in the IV regression. In Models 1-2, the regressions are implemented using 2020 values for democracy index, thus, the instrumental variable is time invariant. Models 3-4 repeat the IV regressions but utilises time-variant values of democracy index. OLS regression specified with a forward dependent variable is used in Model 5 to implement a lagged effect of environmental performance on financial constraints. Variables are defined in Appendix A. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Table 7: Further analysis - Potential global environmental pressure

	High Emission Country		Early Paris Adoption		Cross-listed firms	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	KZ	KZ	KZ	KZ	KZ	KZ
ENV_SCORE	-0.0065***		-0.0064***		-0.0093***	
	(0.0015)		(0.0019)		(0.0010)	
EMI_SCORE		-0.0024*		-0.0032**		-0.0047***
		(0.0013)		(0.0015)		(0.0008)
HIGH_EMISSION	-0.2482	-0.3008				
	(0.3494)	(0.3518)				
ENV_SCORE x HIGH_EMISSION	-0.0054***					
	(0.0017)					
EMI_SCORE x HIGH_EMISSION		-0.0052***				
		(0.0014)				
EARLY_PARIS			-0.3694	-0.3771		
			(0.2975)	(0.2949)		
ENV_SCORE x EARLY_PARIS			-0.0041**			
			(0.0020)			
EMI_SCORE x EARLY_PARIS				-0.0028*		
				(0.0016)		
CROSS_LISTED					0.2505***	0.3430***
					(0.0965)	(0.0979)
ENV_SCORE x CROSS_LISTED					-0.0031	
					(0.0021)	
EMI_SCORE x CROSS_LISTED						-0.0047***
						(0.0018)
CONSTANT	1.9645	2.3406	2.2138	2.5544*	1.7970	2.1258
	(1.6467)	(1.6631)	(1.4461)	(1.4647)	(1.6481)	(1.6635)
CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,581	8,581	8,581	8,581	8,581	8,581
Adjusted R-squared	0.5135	0.5108	0.5131	0.5099	0.5130	0.5103

This table presents results of the relations between environmental performance and financial constraints based on standard OLS regressions. It considers the mediating role of global environmental pressure from three potential sources (i.e., high emission countries in Models 1 and 2, countries that adopted the Paris Accord early in Models 3 and 4, and cross-listed firms in Models 5 and 6). The analysis assumes that stakeholder pressure on firms to take environmental action should be stronger in: (i) countries that emit high carbon; (ii) countries that adopted the Paris Agreement early; and (iii) firms that are cross-listed. The dependent variable is the KZ index. We control for industry-, year-, and country-fixed effects in all models. Variables are defined in Appendix A. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Table 1: Data filtering process and sample distribution by country and year

Panel A: The data filtering process

No	Process	Sample
1	Obtain a list of emerging countries using the FTSE country classification list	24 countries
2	Access a list of firms that have ESG data available	10,518 firms
3	Delete firms from non-emerging countries	9,042 firms
4	Delete firms from the financial industry	263 firms
5	Delete firms with missing ESG data, financial data and country-level data	22 firms
6	Final sample firms from 2003-2020	1,191 firms

Panel B: The sample distribution by country and year

Country/Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	%
Brazil (H)	1	1	1	1	8	15	28	67	71	72	77	75	72	74	81	82	102	53	**881**	**10.27**
Chile					2	5	12	17	17	18	18	19	19	33	34	34	31	4	**263**	**3.06**
China (H)	26	27	33	34	39	39	47	48	45	49	51	51	52	50	57	99	104	82	**933**	**10.87**
Colombia						1	1	5	6	6	7	7	7	13	16	15	13	3	**100**	**1.17**
Czech Republic					1	2	3	3	3	3	3	3	3	3	3	3	3		**36**	**0.42**
Egypt						1	1	7	7	7	7	7	6	6	7	6	4	1	**67**	**0.78**
Greece	5	7	11	10	12	12	13	12	12	11	11	11	11	11	15	19	19	2	**204**	**2.38**
Hungary						1	2	3	3	3	3	3	3	3	3	4	4	2	**37**	**0.43**
India (H)					5	16	24	48	63	66	69	74	77	80	84	92	124	115	**937**	**10.92**
Indonesia (H)						3	8	20	20	23	28	30	33	34	36	37	39	14	**325**	**3.79**
Kuwait						1	1	1	1	1	1	1	8	8	7	7	6		**43**	**0.50**
Malaysia						8	13	30	34	36	39	40	43	43	48	50	52	38	**474**	**5.52**
Mexico (H)	1	1	1	1	3	10	13	17	19	22	24	30	29	33	37	40	36	14	**331**	**3.86**
Pakistan															2	2	2	2	**8**	**0.09**
Peru						1	1	1	2	2	2	2	3	26	27	27	25	5	**124**	**1.45**
Philippines						1	4	13	17	17	19	21	22	22	22	22	21	10	**211**	**2.46**
Poland					1	3	5	16	18	19	19	22	21	21	22	30	27	8	**232**	**2.70**
Qatar						1	1	1	1	1	1	7	8	8	8	9	9	7	**62**	**0.72**
Russia (H)	1	1	1	2	7	20	27	27	27	28	29	30	31	30	28	36	38	7	**370**	**4.31**
South Africa (H)						9	12	37	60	112	111	107	104	102	103	103	105	91	**1056**	**12.31**
Taiwan			1		3	10	24	105	110	109	114	116	117	118	122	128	129	10	**1216**	**14.17**
Thailand					1	4	7	15	14	19	22	26	28	31	32	37	79	33	**348**	**4.06**
Turkey (H)						7	9	16	18	18	19	20	19	19	23	43	41	9	**261**	**3.04**
United Arab Emirates						2	2	2	2	2	2	5	7	8	10	11	9		**62**	**0.72**
Total	**34**	**37**	**48**	**48**	**82**	**172**	**258**	**511**	**570**	**644**	**676**	**707**	**723**	**776**	**827**	**936**	**1022**	**510**	**8581**	**100**

High carbon-emitting countries are denoted by "H". The high-emitting countries each contributed at least 1% to global CO_2 emissions in 2017.

Table 2: Summary statistics

Variables	Full Sample (1)			High Carbon-Emitting Countries (2)			Low Carbon-Emitting Countries (3)			Difference in mean values between High and Low Emitting Countries (2) – (3)		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	Difference	T-test	P-value
KZ	8581	-1.024	2.461	5094	-0.978	2.375	3487	-1.092	2.581	0.114	2.097	0.036**
WW	8580	-0.458	0.120	5094	-0.466	0.148	3486	-0.445	0.061	-0.021	-7.868	0.000***
ENV_SCORE	8581	37.472	26.393	5094	39.912	26.140	3487	33.907	26.360	6.005	10.415	0.000***
EMI_SCORE	8581	42.498	31.640	5094	44.608	30.948	3487	39.415	32.383	5.193	7.491	0.000***
SIZE	8581	15.090	1.278	5094	15.109	1.355	3487	15.061	1.155	0.048	1.747	0.081*
AGE	8581	23.052	9.688	5094	23.509	10.575	3487	22.386	8.177	1.123	5.282	0.000***
TOBIN'S Q	8581	0.003	0.068	5094	0.001	0.002	3487	0.006	0.106	-0.005	-2.860	0.004**
COLLATERAL	8581	0.364	0.232	5094	0.351	0.238	3487	0.383	0.223	-0.032	-6.409	0.000***
ROA	8581	7.559	8.089	5094	8.240	8.569	3487	6.563	7.216	1.677	9.480	0.000***
TA_GROWTH	8581	0.114	0.375	5094	0.126	0.302	3487	0.098	0.461	0.028	3.387	0.001***
IND_CONCENTRATION	8581	0.243	0.121	5094	0.243	0.134	3487	0.242	0.099	0.001	0.338	0.736
CROSS_LISTED	8581	0.159	0.366	5094	0.223	0.416	3487	0.067	0.249	0.156	19.864	0.000***
RETURN_VOLATILITY	8581	0.037	0.659	5094	0.043	0.854	3487	0.029	0.037	0.014	0.996	0.319
GOV_SCORE	8581	48.005	22.455	5094	48.936	22.134	3487	46.643	22.852	2.293	4.653	0.000***
COM_SCORE	8581	48.908	30.672	5094	53.825	29.236	3487	41.725	31.302	12.100	18.293	0.000***
BOD_GEN_DIVERSITY	8581	11.356	11.612	5094	11.953	11.425	3487	10.484	11.828	1.469	5.766	0.000***
MGT_GEN_DIVERSITY	8581	12.135	13.436	5094	10.058	12.002	3487	15.169	14.777	-5.111	-17.615	0.000***
GDP_GROWTH	8581	2.874	3.604	5094	2.449	3.779	3487	3.496	3.233	-1.047	-13.354	0.000***
GDP_PER_CAPITA	8581	9.150	0.946	5094	8.774	0.741	3487	9.699	.943	-0.925	-50.722	0.000***

Variables are defined in Appendix A

Table 3: Correlation matrix table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) KZ	1.000																		
(2) WW	0.076	1.000																	
(3) ENV_SCORE	-0.023	-0.138	1.000																
(4) EMI_SCORE	**0.007**	-0.137	0.901	1.000															
(5) SIZE	0.234	-0.229	0.361	0.385	1.000														
(6) AGE	-0.035	-0.096	0.201	0.177	0.125	1.000													
(7) TOBIN'S Q	**0.011**	0.019	0.032	0.029	**-0.009**	-0.042	**1.000**												
(8) COLLATERAL	0.140	**0.016**	0.092	0.113	0.180	-0.061	**-0.005**	1.000											
(9) ROA	-0.656	-0.109	**-0.016**	-0.023	-0.108	0.026	**0.007**	-0.087	1.000										
(10) TA_GROWTH	-0.066	-0.142	-0.051	-0.049	0.041	-0.056	**-0.008**	**-0.002**	0.142	1.000									
(11) IND_CONCENTRATION	-0.069	-0.023	-0.044	-0.025	-0.080	-0.068	**-0.016**	-0.153	0.060	**0.006**	1.000								
(12) CROSS_LISTED	**-0.016**	-0.057	0.135	0.122	0.095	0.350	**-0.012**	-0.079	0.019	-0.019	0.021	1.000							
(13) RETURN_VOLATILITY	**-0.005**	**-0.003**	-0.019	-0.018	**0.000**	-0.018	**-0.001**	**0.000**	**0.004**	**0.008**	**-0.002**	**-0.006**	**1.000**						
(14) GOV_SCORE	-0.036	-0.091	0.410	0.389	0.191	0.093	**-0.009**	-0.022	**0.010**	-0.023	**0.016**	0.082	**0.005**	1.000					
(15) COM_SCORE	-0.044	-0.107	0.533	0.506	0.239	0.166	**0.012**	-0.020	0.054	-0.025	-0.019	0.121	**-0.017**	0.423	1.000				
(16) BOD_GEN_DIVERSITY	-0.034	**-0.015**	0.099	0.084	-0.144	0.084	**0.010**	**-0.005**	**-0.012**	**-0.017**	**0.003**	0.104	**-0.013**	0.172	0.083	1.000			
(17) MGT_GEN_DIVERSITY	-0.067	0.058	-0.034	-0.040	-0.164	-0.049	**-0.013**	0.046	0.029	0.019	**-0.015**	-0.049	**-0.009**	0.087	0.034	0.331	1.000		
(18) GDP_GROWTH	-0.043	**-0.005**	-0.075	-0.064	0.094	0.087	**0.005**	**-0.007**	0.127	0.051	0.043	-0.032	-0.024	-0.035	-0.023	-0.171	-0.084	1.000	
(19) GDP_PER_CAPITA	-0.039	0.054	-0.035	-0.030	-0.030	-0.061	**-0.012**	-0.046	-0.135	-0.052	0.056	-0.018	**-0.001**	-0.055	-0.264	-0.067	-0.031	-0.120	1.000

Correlation coefficients in bold are not statistically significant at conventional levels. Variables are defined in Appendix A

Appendix A: Variable definitions

Variables	Acronym	Sign	Definition	Source
KZ index	KZ		The KZ Index is a relative measurement of financial constraints. Firms with a higher KZ Index scores are considered financially constrained while firms with a lower KZ Index are seen as financially unconstrained. It is calculated as follows: $KZIndex_t = -1.002 \times (CashFlow_t/Total\ Assets_{t-1}) + 0.283 \times Q_t + 3.139 \times Leverage_t - 39.368 \times (Dividends_t/Total\ Assets_{t-1}) - 1.315 \times (Cash\ Holdings_t/Total\ Assets_{t-1})$.	Datastream
WW index	WW		The WW Index is a relative measurement of financial constraints. Firms with a higher WW Index scores are considered financially constrained while firms with a lower WW Index are seen as financially unconstrained. It is measured as follows: $WW_t = -0.091 \times (Cash\ Flow_t/Total\ Assets_{t-1}) - 0.062 \times Dividend_t + 0.021 \times (Long-term\ Debt_t/Total\ Assets_{t-1}) - 0.044 \times ln(Total\ Assets_t) + 0.102 \times Industry\ Sale\ Growth_t - 0.035 \times Firm\ Sale\ Growth_t$.	Datastream
Overall Environmental Score	ENV_SCORE	-	The environmental pillar measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long-term shareholder value.	Datastream
Environmental Emissions Score	EMI_SCORE	-	Emission category score measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.	Datastream
Firm Size	SIZE	-	Natural logarithm of a firm's total assets.	Datastream
Firm Age	AGE	-	Age is the number of years between a firm listed and the relative fiscal year.	Datastream
Firm Tobin's Q	TOBIN'S Q	+	Tobin's Q is the ratio of a firm's market value to book value.	Datastream
Collateral Assets	COLLATERAL	-/+	The collateral asset ratio is measured as fixed assets to total assets.	Datastream
Profitability	ROA	-	It is a measure of financial performance calculated by dividing net income by total assets.	Datastream
Firm Asset Growth	TA_GROWTH	-/+	Represents the annual total assets growth of the company in the related year.	Datastream
Industry Concentration	IND_CONCENTRATION	-/+	Industry concentration ratio is the proportion of the industry (market) sales attributable to the top three firms each year. It is computed as the sum of sales of the top three firms scaled by aggregate industry sales each year.	Datastream
Cross-listing status	CROSS-LISTED	-/+	It is a dummy variable which is 1 if a company's common shares are traded on a different exchange than its primary and/or original stock exchange, zero otherwise	Datastream
Return Volatility	RETURN_VOLATILITY	+	Standard deviation of cash flow from operations over the past three consecutive years scaled by total assets	Datastream
Governance Pillar Score	GOV_SCORE	-	Governance Pillar Score is the weighted average relative rating of a company based on the reported governance information and the resulting three governance category scores.	Datastream
Board Diversity	BOD_GEN_DIVERSITY	-	Percentage of female on the board.	Datastream
Executive Members' Gender	MGT_GEN_DIVERSITY	-	Percentage of female executive members.	Datastream
Gross Domestic Product growth	GDP_GROWTH	-	Annual GDP growth of a country.	IMF
GDP Per Capita	GDP_PER_CAPITA	-	Natural logarithm of annual GDP per capita which is calculated by dividing the GDP of a country by its population.	IMF

Online Appendix

Environmental Performance and Financial Constraints in Emerging Markets

Henry Agyei-Boapeah[16], Neytullah Ciftci, John Malagila, Jennifer Brodmann, and Samuel Fosu

Section 1 – Testing the robustness of the baseline result to different sample composition

Although the study's sample is drawn from 24 emerging market countries, five countries (i.e., Taiwan, South Africa, India, China, and Brazil) alone contribute almost 60% to the firms in the sample. Therefore, we test whether our main finding is driven by the firms from the five over-represented countries. The results for this analysis are presented below and suggest that the baseline result of a negative relationship between environmental performance and financial constraint holds irrespective of the sample composition.

Robustness test - Generalisability of results across sample countries

Model	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	KZ	KZ	KZ	KZ	KZ	KZ
ENV_SCORE	-0.0099***	-0.0086***	-0.0073***	-0.0084***	-0.0093***	-0.0108***
	(0.0011)	(0.0012)	(0.0013)	(0.0015)	(0.0018)	(0.0011)
COM_SCORE	-0.0037***	-0.0045***	-0.0045***	-0.0042***	-0.0036***	-0.0013
	(0.0009)	(0.0010)	(0.0011)	(0.0013)	(0.0014)	(0.0010)
GOV_SCORE	0.0006	0.0016	0.0002	0.0009	-0.0006	-0.0004
	(0.0011)	(0.0012)	(0.0013)	(0.0014)	(0.0016)	(0.0012)
SIZE	0.4141***	0.4292***	0.4700***	0.4415***	0.4375***	0.2838***
	(0.0279)	(0.0316)	(0.0366)	(0.0453)	(0.0490)	(0.0328)
AGE	-0.0075***	-0.0142***	-0.0158***	-0.0156***	-0.0196***	-0.0009
	(0.0024)	(0.0026)	(0.0028)	(0.0037)	(0.0038)	(0.0029)
TOBIN'S Q	0.5895***	0.6049***	0.6408***	0.6602***	0.6459***	-245.8615***
	(0.1419)	(0.1454)	(0.1368)	(0.1405)	(0.1365)	(57.3482)
TA_GROWTH	-0.0243	-0.0386	-0.0665	-0.0496	-0.0406	0.0236
	(0.1238)	(0.1269)	(0.1235)	(0.1251)	(0.1319)	(0.1888)
COLLATERAL	0.6531***	0.5613***	0.4799***	0.3952***	0.1856	1.0920***
	(0.0947)	(0.1034)	(0.1122)	(0.1285)	(0.1559)	(0.0961)
ROA	-0.1982***	-0.2041***	-0.2022***	-0.2215***	-0.2214***	-0.1537***
	(0.0061)	(0.0070)	(0.0079)	(0.0095)	(0.0107)	(0.0080)
RETURN_VOLATILITY	-0.0098	-0.0078	-0.0046	-0.0006	0.0007	-2.0189

[16]Corresponding author: henry.agyei-boapeah@nottingham.ac.uk

	(0.0083)	(0.0069)	(0.0064)	(0.0063)	(0.0051)	(2.4575)
BOD_GEN_DIVERSITY	-0.0037	-0.0048*	-0.0063**	-0.0086***	-0.0103***	0.0033
	(0.0024)	(0.0026)	(0.0027)	(0.0031)	(0.0034)	(0.0025)
MGT_GEN_DIVERSITY	-0.0037*	-0.0029	-0.0013	0.0018	0.0020	-0.0074***
	(0.0020)	(0.0023)	(0.0025)	(0.0026)	(0.0028)	(0.0023)
CROSS-LISTED	0.1556**	0.2013***	0.1924**	0.0209	-0.2491	0.2204***
	(0.0665)	(0.0744)	(0.0811)	(0.1083)	(0.1572)	(0.0616)
IND_CONCENTRATION	-0.2012	1.6889	2.8345**	3.7165**	6.9015***	-3.7234***
	(1.1561)	(1.2149)	(1.2853)	(1.7757)	(1.9567)	(1.1568)
GDP_GROWTH	-0.0072	-0.0065	-0.0098	-0.0114	-0.0090	-0.0041
	(0.0118)	(0.0118)	(0.0137)	(0.0142)	(0.0163)	(0.0137)
GDP_PER_CAPITA	-0.9251***	-1.1061***	-0.9268***	-0.7608***	-0.6937***	-0.7734***
	(0.1663)	(0.1776)	(0.1991)	(0.2086)	(0.2522)	(0.1988)
CONSTANT	3.2171*	3.8516**	1.4007	-0.5230	-2.5720	4.7695***
	(1.7690)	(1.8718)	(2.0833)	(2.4313)	(2.8829)	(1.7404)
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,365	6,309	5,372	4,439	3,558	5,023
Adjusted R-squared	0.5082	0.5119	0.4990	0.5207	0.5230	0.5684

This table presents results of the relations between environmental performance and financial constraints based on standard OLS regressions. The dependent variable is the KZ index. We control for industry-, year-, and country-fixed effects in all models. The analysis here checks the robustness of the baseline result to our sample composition by dropping some of the top represented sample countries. In Model 1, the topmost represented country (Taiwan) is dropped; In Model 2, the top 2 sample countries (Taiwan and South Africa) are dropped; In Model 3, the top 3 sample countries (Taiwan, South Africa and India) are dropped; In Model 4, the top 4 sample countries (Taiwan, South Africa, India and China) are dropped; In Model 5, the top 5 sample countries (Taiwan, South Africa, India, China and Brazil) are dropped. Model 6 includes only the 5 top 5 represented countries (Taiwan, South Africa, India, China and Brazil). Variables are defined in Appendix A of the main paper. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively.

Section 2 – The relative importance of environmental concerns and the other aspects of CSR

Environmental responsibility forms part of the broader concept of CSR but environmental concerns seem to disproportionately obtain more attention from policy makers, academics, and practitioners. This may partly be due the link between climate change risk and environmental sustainability. In this section, we utilize our existing empirical framework to explore the relative importance of the major elements of CSR to investors. We conduct this analysis by comparing the magnitude of the benefits (i.e., the extent of financial constraint reductions) obtained when firms invest in specific aspects of CSR. The results below show a dominant effect of environmental performance over the other components of CSR, suggesting that corporate stakeholders, particularly investors prioritize environmental concerns over the other aspects of the firm's CSR activities.

The effect of the individual CSR components on financial constraint

Model	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	KZ	KZ	KZ	KZ	KZ	KZ
ENV_SCORE	-0.0118***	-0.0073***	-0.0100***	-0.0112***	-0.0099***	-0.0070***
	(0.0009)	(0.0012)	(0.0010)	(0.0010)	(0.0011)	(0.0012)
SOC_SCORE		-0.0068***				-0.0055***
		(0.0012)				(0.0016)
COM_SCORE			-0.0033***			-0.0008
			(0.0008)			(0.0010)
GOV_SCORE				-0.0017*		-0.0008
				(0.0009)		(0.0010)
CSR_SCORE					-0.0024***	-0.0001
					(0.0009)	(0.0010)
CONSTANT	2.0024	1.5789	1.7855	2.0945	1.8593	1.5579
	(1.6419)	(1.6449)	(1.6456)	(1.6413)	(1.6454)	(1.6494)
CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
YEAR FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
COUNTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
INDUSTRY FIXED EFFECT	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,581	8,581	8,581	8,581	8,581	8,581
Adjusted R-squared	0.5120	0.5137	0.5129	0.5121	0.5124	0.5136

This table presents results of the relations between environmental performance and financial constraints based on standard OLS regressions. It explores the relative importance of environmental concerns to the other CSR dimensions (i.e., social score, community score, governance score and CSR score). The dependent variable is the KZ index. We control for industry-, year-, and country-fixed effects in all models. Model 1 examines the effect of environmental performance alone on financial constraints; Model 2 explores the relative importance of environmental performance and social performance; Model 3 considers the relative importance of environmental performance and community performance; Model 4 examines the relative importance of environmental performance and governance performance; and Model 5 examines the relative importance of environmental performance and CSR. Finally, in Model 6, we explore the relative importance of all the different dimensions of ESG/CSR. Variables are defined in Appendix A. Figures in parentheses are robust standard errors. ***, **, and * denote that the coefficients are statistically significant at 1%, 5%, and 10%, respectively.