ESG changes and credit rating revisions during the COVID-19 pandemic

Abstract

This study investigates the relationship between Environmental, Social, and Governance (ESG) changes and credit rating revisions during the COVID-19 pandemic. While the pandemic triggered global economic disruptions and increased default risks, leading to widespread credit rating downgrades, the role of sustainability as a risk mitigant during this period remains underexplored. Using a global sample of non-financial companies across 47 countries from 2015 to 2022, this research adopts a dynamic approach by analyzing yearly ESG score variations. Empirical results demonstrate that firms with positive ESG improvements experienced significantly less severe credit rating downgrades during the pandemic period. These findings suggest that credit rating agencies perceive ESG enhancements as credible signals of risk mitigation and corporate resilience. Therefore, strengthening ESG practices might help protect a firm's credit profile and access to debt markets during periods of extreme economic stress.

Keywords: ESG, ESG changes, credit rating revision, COVID-19 pandemic.

1 Introduction

Crises can take many forms, including financial, political, natural or public emergencies. The COVID-19 pandemic represents a specific type of crisis, originating outside the financial system and quickly escalating into a global economic and public health disruption. Unlike previous financial crises, such as the 2007–2009 crisis, which typically evolved over several years, the pandemic caused immediate and widespread effects on public health, supply chains, labour markets, and corporate policies (Ding et al., 2021; Zheng, 2022). Societal and economic measures, including new corporate policies, were implemented in response to these disruptions (Zheng, 2022). During this period, social and environmental issues gained global attention, intensifying the debate on how companies could strengthen their commitment to sustainability-related matters (Bae et al., 2021).

Sustainable initiatives act as Environmental, Social, and Governance (ESG) practices and potentially mitigate firms´ agency costs and information asymmetry (El Ghoul et al., 2011). Furthermore, these initiatives can reduce financial constraints, influence banks' financing policies toward firms, and decrease their credit risk levels by showing transparency and efficient usage of internal resources in non-financial disclosure (Attig et al., 2013). Therefore, commitments to environmental, social, and governance concerns serve as instrumental tools to enhance a firm´s

reputation and bolster its creditworthiness (Gracia & Siregar, 2021). Additionally, ESG practices can build long-term trust between companies and key stakeholders during periods of crisis (Stellner et al., 2015), highlighting the broader significance of sustainable efforts and the benefits they can confer upon organizations.

The focus on societal and environmental issues increased across various economic sectors following the government-enforced lockdown, with the media as an external information intermediary within the market (Cheng & Feng, 2023). For instance, stakeholders have increasingly prioritized sustainability concerns in response to the realities of the COVID-19 pandemic and its associated lockdowns (He & Harris, 2020).

This shift supports the view that stakeholders are now more inclined to support businesses that respond constructively to crises (Ding et al., 2021). Moreover, the COVID-19 pandemic has underscored the importance of ESG strategies encouraging firms to take responsibility for environmental and societal challenges (He & Harris, 2020). These strategies not only create value for investors (García-Sánchez & García-Sánchez, 2020) but also emphasize the relevance of sustainable initiatives as key drivers of a positive reputation (Houqe et al., 2020; Stellner et al., 2015), strengthening business resilience during the pandemic.

The adverse effects of the pandemic have notably increased the risk of defaults and consequently compromised the credit quality of firms (Bielecki, 2004; Jones et al., 2015). Elevated risks have led to declines in corporate revenues and profitability, depletion of cash reserves, and greater uncertainty about future cash flows for many companies (Acharya & Steffen, 2020; Ding et al., 2021; He & Xiong, 2012).

By assessing companies' balance sheets, cash flow statements, and economic conditions, the credit agencies evaluate financial constraints and influence companies' access to credit, as they play a role in assessing financial losses and default risks (Acharya & Steffen, 2020; Chien et al., 2023). In doing so, they are likely to adjust the ratings to reflect a firm's creditworthiness in a timely manner and contribute to reducing information asymmetry in financial markets, especially during times of crisis.

Traditionally, credit rating agencies have focused primarily on financial metrics in their assessments. However, a shift has been toward incorporating non-financial factors, such as ESG practices. Prior studies (Attig et al., 2013; Jiraporn et al., 2014; Safiullah et al., 2021) support this trend, highlighting the increasing recognition of ESG's role in evaluating creditworthiness.

Assessing ESG is essential, as it plays a role in mitigating corporate risks. Moreover, ESG serves as an indicator of a company's corporate governance mechanisms. These practices help alleviate information asymmetry (Cuadrado-Ballesteros et al., 2016), by offering investors

improved access to governance information, enhancing risk assessment practices and supporting more accurate financial decision-making (Attig et al., 2013; Liu et al., 2023).

A prior study (Arnal et al., 2021) concluded that Eurozone sovereign ratings remained relatively stable during the COVID-19 pandemic. Building on this approach, we extend the analysis to listed firms but anticipate an increase number of credit downgrades. This expectation arises from recognizing that credit rating agencies often display a responsive attitude during economic crises, assigning lower credit ratings than expected under normal circumstances (Acharya & Steffen, 2020).

Our analysis investigates whether ESG practices provided firms any benefits during the COVID-19 pandemic. Specifically, we examine whether companies that placed greater emphasis on sustainability received positive evaluations in credit risk assessments by credit rating agencies, potentially shielding them from negative credit rating revisions. We hypothesize that firms experiencing positive changes in ESG practices were less likely to receive negative credit rating revisions (downgrades) during the pandemic. One premise of this hypothesis is that the social capital generated by ESG initiatives assumes heightened importance during crises, when stakeholder trust in corporations is diminished (Lins et al., 2017). This supports the notion that ESG practices act as a form of ‘moral capital,’ shielding firms from stakeholder sanctions in response to adverse events (Bannier et al., 2021).

This study contributes to the ongoing debate within existing research on this topic surrounding the effectiveness and motivations of ESG in corporate decision-making. On the one hand, some argue that ESG is a fundamental tool that enhances a firm's overall value. These scholars emphasize the positive influence of ESG on various aspects, including reputation, stakeholder relationships, and long-term sustainability (Gracia & Siregar, 2021). On the other hand, critics posit that ESG primarily attends to private interests or is even considered an inefficient allocation of resources (Kao et al., 2018). ESG´s impacts on reputation can lead to agency conflicts and over-investments. Bannier et al. (2021) and Diemont et al. (2016) suggest that incentive practices—particularly those tied to ESG—can mask corporate misconduct. For instance, managers may prioritize ESG investments over the firm's core business, introducing the risk of misaligned incentives and distorted investment decisions.

Additionally, it remains essential to analyse whether sustainable firms experienced any advantages during the COVID-19 pandemic crisis, either in the form of increased resilience or reduced exposure to downside risk. Several studies analysing credit rating revisions during the COVID-19 pandemic have found evidence that the crisis increased default risk by directly impacting firms' future cash flows, primarily due to liquidity challenges. As a result, firms

experienced negative credit rating revisions (Acharya & Steffen, 2020). However, limited research explores how improvements in ESG might influence the relationship between the pandemic and credit rating revisions, highlighting a gap for further exploration in this area.

To our knowledge, no research has established a connection between the relevance of ESG changes during the COVID-19 pandemic and subsequent credit rating revisions of firms, particularly negative credit rating revisions. The investigation can offer valuable insights into sustainable companies' financial impact and resilience throughout the challenges posed by the COVID-19 pandemic. Therefore, this unique circumstance provides an opportunity to examine whether credit rating agencies interpret ESG activities as a signal of risk mitigation. Our study aims to fill this gap. Existing literature indicates that ESG practices, defined as 'soft information' (Menz, 2010), can influence the cost of debt (Attig et al., 2013; Gracia & Siregar, 2021; La Rosa et al., 2018), playing a role in credit rating. This study explores credit rating revisions during the COVID-19 pandemic, focusing on the impact of ESG-related intangible factors. By adopting a dynamic perspective on ESG, we aim to provide a broader understanding of companies' sustainability commitment and initiatives. Furthermore, carefully examining ESG changes allows for clearly identifying trends and patterns in firms' ESG practices in short term, offering insights into their strategic responses to sustainability.

Our findings show that firms with improved ESG practices experienced less negative impacts on their credit rating revisions during the COVID-19 pandemic, as we hypothesized.

The structure of this study unfolds as follows: Section 2 delves into relevant literature and formulates research hypotheses; Section 3 outlines the methodology, including sample selection, variable definitions, and the regression model employed; Section 4 explains our baseline findings; and Section 5 concludes.

2 Literature Review

2.1 ESG during the COVID-19 pandemic

In recent decades, ESG practices have become an integral part of corporate risk management, leading to positive outcomes such as improved financial performance (Kim & Li, 2021). ESG helps companies address critical challenges, including agency problems, information asymmetry, and reputational risk (Cheng et al., 2014; Hoepner et al., 2016; Jensen & Meckling, 1976; Romito & Vurro, 2021). Moreover, ESG practices show how businesses can incorporate the expectations of key stakeholders—such as employees, suppliers, customers, and local communities—into their broader strategic goals. Theories such as stakeholder, legitimacy, and institutional theory highlight that a company's commitment to ESG strengthens its relationships with stakeholders by aligning

the company's goals with the several demands of these groups (Bae et al., 2021; Gracia & Siregar, 2021; Xie et al., 2017). This integration enables companies to navigate complex and challenging environments more effectively (Cheng & Feng, 2023).

However, the debate surrounding ESG practices intensified during the COVID-19 pandemic, as environmental and social issues became central to discussions among governments, particularly in response to emergency measures like lockdowns and their long-term implications. This increased emphasis on ESG has influenced both government agendas and the strategies of market participants (Bae et al., 2021). Previous studies (Albuquerque et al., 2020; Houqe et al., 2020) demonstrate how ESG practices improve product differentiation and expand the diversification of firms' product portfolios, reducing exposure to systematic risk and mitigating downside risks during challenging periods. In contrast, some authors found no evidence that high-sustainability funds outperform low-sustainability funds (Broadstock et al., 2021; Hao & Renneboog, 2019). Other studies suggest that executives may use ESG to enhance their reputations at the expense of shareholders (Benabou & Tirole, 2010; Ding et al., 2021).

Hence, the COVID-19 pandemic presents a unique opportunity to examine whether ESG practices, as risk mitigation, can protect sustainable companies and potentially result in fewer financial losses during the crisis.

2.2 The relationship of ESG on credit rating revisions during the COVID-19 pandemic

Rating Revisions During a Crisis

The assessment of creditworthiness and a firm's financial obligations is a critical measure of its financial constraints, greatly influencing its access to credit (Acharya & Steffen, 2020). Credit rating agencies play a role in determining how credit ratings are assigned to issuers, relying on financial and non-financial information that affects the credit quality of firms (Bielecki, 2004; Jones et al., 2015). These ratings play a role in the globalization of financial markets, serving as essential tools for financial regulation and contracting, especially in the face of the increasing complexity of financial products (Bielecki, 2004), and contributing to mitigating asymmetric information in capital markets.

However, in turbulent times, credit ratings may play an important role in assessing and effectively responding to the challenges posed by economic downturns. Even so, the role of credit rating agencies during crises remains controversial. Credit ratings on many financial instruments failed to accurately reflect default risk before and during the 2007–2009 financial crisis. For instance, during this crisis, the volume of BBB-rated debt increased significantly, with credit increasingly extended to higher-risk borrowers characterized by elevated leverage (Acharya & Steffen, 2020). Since then, rating agencies have been compelled to improve their performance,

driven by reputational damage resulting from public criticism and increased regulatory pressures. As a result, sovereign and corporate ratings, which had remained relatively high in the years leading up to the crisis, were downgraded (Arnal et al., 2021).

The global crisis triggered by the COVID-19 pandemic profoundly disrupted the world economy, leading to significant shifts in consumer behaviour, upheavals in the labour market, and disruptions in global supply and demand chains (Zheng, 2022). The economic lockdown and the subsequent prolonged recession heightened default risks. Similar to the 2007–2009 financial crisis (He & Xiong, 2012), these heightened risks directly impacted companies' future cash flows and increased rollover risk. In response, credit rating agencies issued more negative revisions, mainly targeting companies rated BBB-, the lowest investment-grade category. When downgraded, these companies fall into non-investment-grade status, commonly called "fallen angels" (Acharya & Steffen, 2020).

The relationship between ESG and Rating Revisions During Crisis

ESG practices help lower agency costs and reduce information asymmetry, thereby enhancing a firm's reputation and creditworthiness (Attig et al., 2013; El Ghoul et al., 2011; Jiraporn et al., 2014; Safiullah et al., 2021). Firms engaged in ESG can mitigate downside risks and reduce exposure to systematic risk (Albuquerque et al., 2020; Broadstock et al., 2021; Houqe et al., 2020; Lins et al., 2017). Moreover, their commitment to sustainability can reduce reputational damage and the probability of litigation, acting as insurance against idiosyncratic firm-specific legal risks (Lins et al., 2017).

In times of crisis, ESG practices further mitigate risk by strengthening stakeholder relationships and addressing their diverse interests. Stronger connections between companies and stakeholders foster job retention, support employment, and enhance the resilience of supply chains and customer relationships during lockdowns. Ultimately, this resilience translates into enhanced profitability, gross margins, and sales growth, improving a company's ability to manage and secure additional debt. Therefore, engaging in sustainable topics tends to pay off in challenging times (Chintrakarn et al., 2021; Ding et al., 2021; Lins et al., 2017). Since credit rating agencies incorporate financial and non-financial factors in their assessments, firms with higher ESG practices should be assigned a lower risk profile, potentially leading to more favourable rating revisions during a crisis.

From a methodological perspective, our study differs from prior research not only in its theoretical focus but also in its empirical design. While existing studies examine the relationship between ESG levels and credit risk using static specifications (Ashbaugh-Skaife et al., 2006; Attig et al., 2013; Jiraporn et al., 2014; Stellner et al., 2015), we adopt a dynamic approach by focusing

on changes in ESG practices and credit rating revisions over time. This choice allows us to capture how rating agencies update their assessments in response to evolving sustainability profiles, particularly during periods of uncertainty such as the COVID-19 pandemic. Moreover, by analysing rating revisions rather than rating levels, we align our empirical strategy with the decision-making process of credit rating agencies, which evaluate firms based on incremental information updates. Our sample construction and model specification are therefore designed to isolate the effect of ESG changes on credit risk assessments from other firm-level heterogeneity during periods of crisis.

Building on the analysis, we hypothesize that credit rating agencies tend to be more lenient toward companies that report ESG improvements. Specifically, we posit that companies experiencing positive ESG changes are less affected by the negative impact of the COVID-19 pandemic on credit rating revisions, even after controlling for firm characteristics and fixed effects. We consider that firms with positive ESG changes demonstrate a solid commitment to ESG initiatives and possess a better capacity to leverage their established reputation with multiple stakeholders, thus enhancing their resilience during periods of crisis. Therefore, we propose the following hypothesis:

Hypothesis: The negative impact of the COVID-19 pandemic on credit rating revisions is less pronounced among companies experiencing positive ESG changes.

3 Research Method

Sample selection and variables

This study examines the relationship between changes in ESG practices and a firm's susceptibility to unfavourable credit rating revisions during the COVID-19 pandemic. First identified in Wuhan, China, in December 2019, COVID-19 is an infectious illness caused by severe respiratory syndrome (Ding et al., 2021). For this research, we define the COVID-19 pandemic as beginning in January 2020, aligning with the activation of the World Health Organization's emergency response framework, as supported by previous studies (Augustin et al., 2022; Ding et al., 2021; Hasan et al., 2023). We also include 2021 in our analysis as a pandemic year, as it captures the multifaceted impacts of the subsequent waves. Our research started five years before the pandemic (2015), enabling us to establish a robust basis for comparing trends during this critical period. By examining data from 2015 to 2022, we aim to gain meaningful insights into the evolving dynamics of the critical variables in our study.

Although the official end of the pandemic was declared in May 2023, we have chosen to exclude 2022 from the COVID-19 pandemic period. During 2022 and 2023, the crisis was increasingly shaped by country-specific policies, whereas in 2020 and 2021, the pandemic

exhibited a globally random dispersion of effects—an outcome considered an exogenous event (Augustin et al., 2022). Therefore, we define the initial five years (2015–2019) as the pre-crisis period, marked with a value of 0, and 2022 as the post-crisis period, also marked as 0. Specifically, we designate 2020 and 2021 as the 'COVID-19 Pandemic,' indicated by a value of 1. This classification aligns with our goal of assessing the pandemic's financial impact on companies.

The ESG score employed in this study originates from the LSEG Workspace database, known for its coverage across ESG dimensions and its extensive time series, which adheres to rigorous selection criteria to mitigate the risk of sample selection bias (Bannier et al., 2021; Cardillo et al., 2023; Ding et al., 2021). Alongside ESG data, our investigation incorporates information on credit ratings and control variables from the same database to investigate the relationship between ESG and negative credit rating revisions. We exclude financial firms and firms with negative equity.

Dependent Variable

Building on prior research (Baker et al., 2022), we employ a similar methodology to convert letter ratings into numerical values. Credit rating agencies use a comparable scale to evaluate firm risk, explicitly assessing the likelihood of a company fulfilling its debt obligations, as outlined in Table 1.

Table 1: *Allocation of Credit Rating Levels*

Allocation of Credit Rating Levels			
Assigned Value		S&P and Fitch Rating	Moody´s Rating
22	Investment Grade	AAA	Aaa
21		AA+	Aa1
20		AA	Aa2
19		AA-	Aa3
18		A+	A1
17		A	A2
16		A-	A3
15		BBB+	Baa1
14		BBB	Baa2
13		BBB-	Baa3
12	Speculative	BB+	Ba1
11		BB	Ba3
10		BB-	Ba1
9		B+	B1

8	B	B2
7	B-	B3
6	CCC+	Caa1
5	CCC	Caa2
4	CCC-	Caa3
3	CC	Ca
2	C	C
1	D	D

Note. The table is used to convert ratings to numerical values.

Our analysis is based on long-term issuer credit ratings from various rating agencies worldwide, including well-known entities like Moody's and Fitch, as well as agencies from China, India, and Malaysia, both at the global and national scale. National-scale credit ratings offer valuable insights into credit quality within a specific country, providing a robust credit risk ranking. However, their lack of international comparability limits cross-border analysis. On the other hand, international credit ratings assess a firm's ability to meet financial obligations on a global scale, whether in foreign or local currency, providing a more universally applicable perspective. To ensure consistency in our analysis, we use the same type of agency and rating scale across all years when assessing credit rating revisions. This approach allows for a cohesive and reliable evaluation and an accurate examination of credit dynamics over time.

Rating revisions can be no change, positive or negative, reflected by the differences in numerical values between a firm's rating levels across consecutive years as provided by the same agency description. For example, if a company has a credit rating described as Fitch Long-Term Issuer Default Rating in one year, to calculate the credit rating revisions in subsequent years, we should use the credit rating that has the same agency description: Fitch Long-Term Issuer Default Rating. In our analysis, a higher rating corresponds to a higher numerical value, so a negative rating revisions, i.e., a downgrade, indicates a decline in a firm’s credit rating corresponding to an increase in the firm’s credit risk.

This study aims to investigate the pattern of credit rating revisions in the context of the COVID-19 pandemic. Credit rating revisions provide a valuable indicator for assessing potential shifts, reflecting rating agencies' current evaluations of a company's risk profile and creditworthiness (Jones et al., 2015).

Explanatory Variable

The adoption of ESG indices has gained prominence in the 2000s, driven by the growing demand for assessing social, environmental, and governance aspects. Several organizations provide ESG

data. Notably, the ESG framework explicitly incorporates governance strengths and concerns, distinguishing it from traditional Corporate Social Responsibility (CSR) that incorporate governance issues indirectly, primarily when they relate to environmental and social topics (Gillan et al., 2021).

The ESG scores within the LSEG Workspace dataset range from 0.1 (indicating the lowest level of firm disclosure) to 100 (representing the highest level of firm disclosure). Following a previous study (Shanaev & Ghimire, 2022), we adopt a yearly variation approach for ESG scores, denoted as ESG changes (ΔESG), rather than relying solely on absolute values. This methodology acknowledges the dynamic nature of ESG practices, enabling a more nuanced evaluation that better captures the evolving complexities of the ESG index. Year-over-year changes in ESG scores can signal improvements or deteriorations in a firm's sustainability practices, offering a more reliable indication of ESG impact and corporate engagement.

Control Variables

Previous studies (Baker et al., 2022; Hwang et al., 2010; Jones et al., 2015; Kim & Li, 2021; Wang et al., 2024) have identified company-specific control variables that theoretically and empirically influence credit ratings. These variables operate to mitigate concerns over omitted variable bias in the results.

The variables are *ln(Revenue),* the natural logarithm of revenue; *Cash*, cash and equivalents plus short-term investments divided by total Assets; *Leverage,* defined as total liabilities divided by total assets, has a straightforward relation to critical variable negative rating revisions; *Beta* is a measure of how much the stock moves for a given move in the market used as an indicator of systematic risk measured during the fiscal year; return on assets *ROA*, income after taxes for the fiscal period divided by the average total assets at the beginning and the end of the year, as financial performance recurring control variable for the analyses, and industry and country fixed effects. If a firm performed well throughout the estimation period because of some unobservable industry and country characteristics, the fixed effect would capture this effect.

3.2 Empirical Models

In this analysis, we apply the Least Squares Dummy Variable (LSDV) regression (Eq.1) to study rating revisions, continuous variable, while using a probit model (Eq.2) to assess the likelihood of negative credit rating revisions, dummy variable, during the crisis. This analysis includes changes in firms' ESG scores, denoted as ΔESG, along with several control variables. Our variable of interest is the interaction between 'Covid Pandemic' and ΔESG throughout the waves of virus circulation in 2020 and 2021, contributing to a more accurate analysis of the pandemic's financial

implications. To assess the effect of this interaction variable on credit rating revisions, particularly negative credit rating revisions, we employ the specifications of the following models:

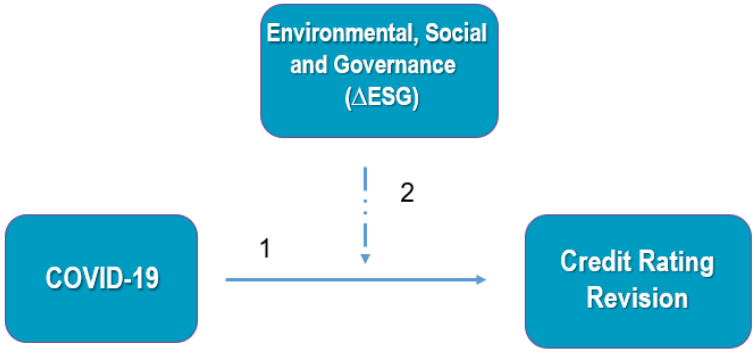
$$Credit\ Rating\ Revision_{it} = \beta_0 + \beta_1 \Delta ESG_{i,t} + \beta_2 Covid\ Pandemic_t + \beta_3 \Delta ESG_{it} * Covid\ Pandemic_t + \alpha_1 X'_{i,t} + \gamma_s + \theta_j + \varepsilon_{it}. \quad (1)$$

$$P\left(Negative\ Credit\ Rating\ Revision_{i,t} = 1\right) = \Phi\left(\beta_0 + \beta_1 \Delta ESG_{i,t} + \beta_2 Covid\ Pandemic_t + \beta_3 \Delta ESG_{it} * Covid\ Pandemic_t + \alpha_1 X'_{i,t} + \gamma_s + \theta_j\right). \quad (2)$$

Where 'i 'and 't' correspond to firm and year, respectively. The dependent variable '$Credit\ Rating\ Revision_{i,t}$', represents the rating revisions of firm 'i' in year 't' and the previous year. The 'Covid Pandemic' variable is subscripted with 't', assuming different values (0 or 1) corresponding to specific time periods. $\Delta ESG_{i,t}$ variable corresponds to the ESG changes for firm 'i' between the years 't' and previous year. '$X'_{i,t}$' is a vector of control variables for firm 'i' in year 't' (Broadstock et al., 2021; Hwang et al., 2010; Kim & Li, 2021), along with an interaction term as shown in Eq.1. We also include industry fixed effects (γ_s) as some industries are more inclined to invest in ESG than others, and country-fixed effects (θ_j) by including industry, and country dummies.

The coefficient β_3 in our model captures the moderating effect of ESG changes (ΔESG) on the relationship between the COVID-19 Pandemic variable and the Credit Rating Revision. We expect β_3 to be positive in Eq. (1) for rating revisions and negative in Eq. (2) for negative revisions, indicating that significant positive ESG changes serve as a risk mitigation factor, potentially protecting companies from negative rating revisions during the COVID-19 pandemic. Figure 3.1 illustrates the main mechanisms highlighted in the literature.

Figure 1: *Conceptual Relationships Tested in Equation (1)*



Note. Source: Author's elaboration.

The arrows in Figure 1 show the relationship between key variables based on the literature. Arrow 1 represents the impact of the COVID-19 pandemic on credit rating revisions (Acharya & Steffen, 2020), while Arrow 2 captures the moderating effect of changes in ESG. Improvements in ESG strengthen firms' relations with key stakeholders such as employees, suppliers, and customers (Ding et al., 2021). Consequently, the negative impact of the COVID-19 pandemic on credit rating revisions is expected to be less pronounced for firms experiencing positive ESG changes.

4 Results

4.1 Data description and summary statistics

Our analysis focuses initially on non-financial companies listed on stock exchanges in 50 countries, categorized by Morgan Stanley Capital International (MSCI) into 23 developed markets and 27 emerging markets across the Americas, Europe, the Middle East, Africa (EMEA), and Asia. We excluded Egypt, Kuwait, and Pakistan from the sample due to the lack of credit rating revisions between 2015 and 2022, bringing the total number of countries considered to 47.

Table 2: *Summary Statistics of the Key Variables*

Panel A: Full Sample

	N	Mean	Q1	Median	Q3	Std. Dev.
Rating revision (continuous variable)	6673	-0.349	0	0	0	1.573
Negative Revision (dummy variable)	6673	0.185	0	0	0	0.389
ESG (absolute value)	6673	52.611	36.957	54.345	68.778	20.426
Δ ESG	6673	2.592	-1.385	1.452	5.548	6.440
Revenue ($ in millions)	6673	8,583.834	1,972.000	4,903.200	12,915.218	8,623.876
Cash	6673	0.119	0.044	0.094	0.162	0.102
Leverage	6673	0.576	0.457	0.580	0.696	0.175
Beta	6673	1.105	0.761	1.047	1.370	0.519
ROA	6673	0.037	0.015	0.036	0.064	0.070

	Non-Pandemic Period N=4,690			Pandemic Period N=1,983			
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.	Wilcoxon Test (z)

Rating revision (continuous variable)	-0.246	0	1.378	-0.592	0	1.937	8.868***
Negative Revision (dummy variable)	0.154	0	0.361	0.260	0	0.439	-10.229***
ESG (absolute value)	51.889	53.499	20.620	54.319	56.226	19.862	-4.294***
Δ ESG	2.313	1.246	6.286	3.251	1.891	6.746	-5.211***
Revenue ($ in millions)	8,820.8	5,145.1	8,690.08	8,023.3	4,312.1	8,440.9	4.431***
Cash	0.116	0.090	0.103	0.125	0.103	0.100	-4.937***
Leverage	0.574	0.577	0.177	0.582	0.586	0.172	-2.136**
Beta	1.07	1.019	0.498	1.192	1.123	0.557	-8.146***
ROA	0.041	0.038	0.067	0.029	0.032	0.076	7.214***

Panel B: Non-Pandemic and Pandemic Period

Note. This table presents descriptive statistics (including observations, mean, median, and standard deviation). Panel A represents the total sample, and Panel B represents the sample divided into two groups: non-pandemic period (N= 4,690) and pandemic period (N = 1,983). The sample period is between 2015 and 2022. The dependent variable, Rating Revision, is the yearly revision of the firm-level credit rating and negative Revision (a dummy variable, where 1 represents a negative revision, and 0 represents either no change or a positive revision). The ESG corresponds to the yearly score given by the LSEG Workspace database, and ESG changes (ΔESG) is the yearly change of the firm-level ESG. Revenue, the total revenue reported by a company, Cash, cash and equivalents plus short-term investments divided by total Assets; Leverage, total liabilities divided by total assets; 'Beta' is a measure of how much the stock moves for a given move in the market used as an indicator of systematic risk measured during the fiscal year; return on assets ROA, income after taxes for the fiscal period divided by the average total assets at the beginning and the end of the year. We use the Wilcoxon Rank-Sum Test to evaluate differences in the distributions between the two groups. The last column reports whether the observations in the Pandemic Period are significantly different from those in the Non-Pandemic Period.

The data presented in Table 2 has undergone winsorization for control variables at the 1% and 99% percentiles to mitigate the impact of outliers. Panel A reports the summary statistics for the total sample. On average, a company experiences a change of -0.349 in its credit rating, meaning a 0.349-notch reduction in its credit rating. The mean of negative rating revision is 0.185, showing that only 18.5% of the sample has a negative revision. The median, Q1, and Q3 are also zero, confirming that most firms experience no changes or positive revisions rather than negative ones. Nevertheless, the extent of negative revisions exceeds that of positive revisions, as evidenced by the mean value of -0.349. The median ESG score is 54.345, with a mean of 52.611 and a standard deviation of 20.456, indicating variability in ESG scores across the sample. On average, firms show an ESG change (ΔESG) of 2.592, indicating improvements in ESG initiatives. This result is consistent with the findings of Shanaev and Ghimire (2022), who examined U.S. companies and found that 96.92% of firms experienced upgrades in their ESG scores. The average

revenue of $8,583.834 million, ranging from $1,972.500 million in the first quartile (Q1) to $12,915.218 million in the third quartile (Q3), suggests that the sample primarily consists of large companies.

Additionally, the average Cash, defined as cash and equivalents plus short-term investments divided by total Assets, is 0.119 (11,9%). This variable reflects the firms' short-term financial health and ability to meet immediate liabilities, exceeding the 7.6% (0.076) that Baker et al. (2022) observed for U.S. companies. The average *Leverage* indicates that 57.6% of the total assets are financed by liabilities, suggesting a potential economic vulnerability for these companies, with a higher leverage ratio compared to the 0.435 found by Wang et al. (2024). A median Beta of 1.0 suggests that the typical firm's stock returns exhibit volatility similar to that of the overall market, as observed for U.S. companies by Attig et al. (2013). Furthermore, the average return on assets (ROA) in our sample is 0.037, showing how firms utilize assets to generate profits. This value is higher than the average ROA of 0.021 reported for U.S. firms by Safiullah et al. (2021), and the 0.015 average observed in international samples by Ding et al. (2021).

Panel B presents the mean, median, and standard deviation for the COVID-19 pandemic and non-pandemic periods. Interestingly, the average rating revisions during the pandemic period is more negative than the non-pandemic period (-0.592 versus -0.246). On average, 26% of firms experienced a negative revision during the pandemic, compared to 15.4% in the non-pandemic period. The median value of zero indicates that more than half of the firms retained their existing credit ratings. These findings suggest an increase in both the frequency and magnitude of credit downgrades during the pandemic period, compared to the non-pandemic period.

To further analyze the differences, we conducted a Wilcoxon Rank-Sum Test to compare the distributions between the two groups. The test results confirmed a statistically significant difference (p-value < 0.001), suggesting that the pandemic period has been associated with increased negative rating revisions. Additionally, separate tests for ESG and ΔESG variables indicated significant increases during the pandemic, with p-values also showing strong statistical significance (p-value < 0.001).

Table 3 presents Spearman's rank correlation coefficients, which assess the monotonic relationships among the primary variables in the models.

Table 3: *Spearman's Rank Correlation Test*

Panel A: Full Sample

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 *Credit Rating Revision*	1.000						

2. Δ*ESG*	0.009	1.000					
3. *ln (Revenue)*	0.044	-0.034	1.000				
4. *Cash*	0.073	0.010	0.063	1.000			
5. *Leverage*	-0.161	-0.008	0.192	-0.247	1.000		
6. *Beta*	-0.079	-0.015	-0.043	0.071	0.068	1.000	
7. *ROA*	0.261	0.036	0.095	0.196	-0.353	-0.114	1.000

Panel B: Non-Pandemic Period

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 *Credit Rating Revision*	1.000						
2. Δ*ESG*	0.004	1.000					
3. *ln (Revenue)*	0.025	-0.033	1.000				
4. *Cash*	0.055	0.009	0.073	1.000			
5. *Leverage*	-0.140	-0.022	0.204	-0.238	1.000		
6. *Beta*	-0.010	-0.022	0.002	0.093	0.038	1.000	
7. *ROA*	0.236	0.027	0.086	0.186	-0.333	-0.055	1.000

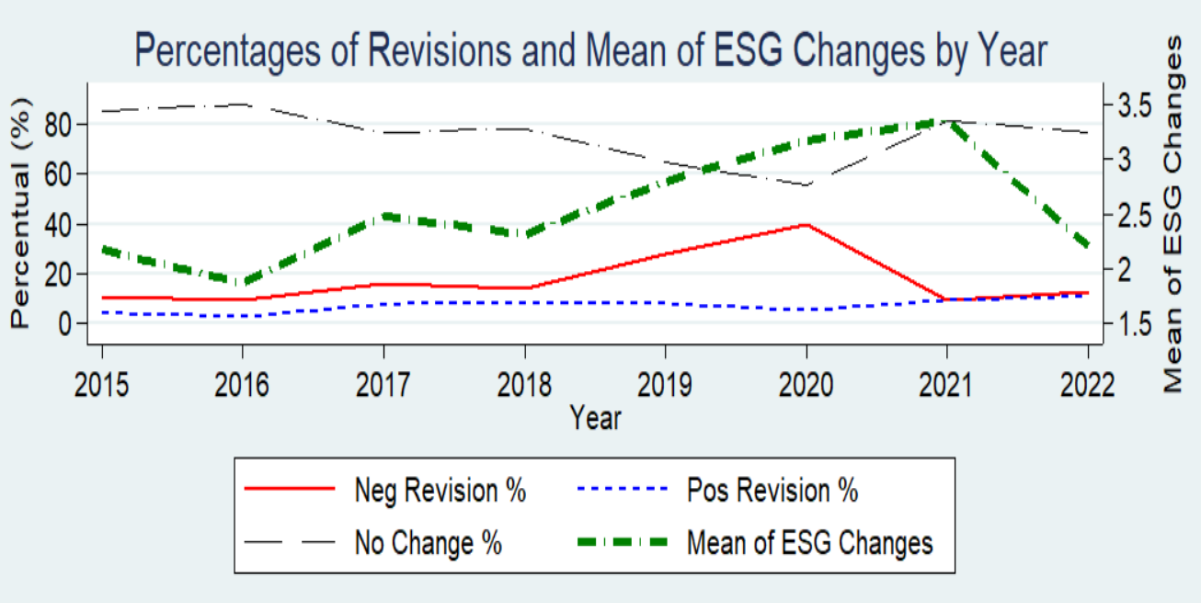
Panel C: Pandemic Period

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 *Credit Rating Revision*	1.000						
2. Δ*ESG*	0.042	1.000					
3. *ln (Revenue)*	0.066	-0.029	1.000				
4. *Cash*	0.131	0.000	0.052	1.000			
5. *Leverage*	-0.200	0.020	0.168	-0.276	1.000		
6. *Beta*	-0.191	-0.022	-0.125	-0.001	0.134	1.000	
7. *ROA*	0.293	0.075	0.102	0.241	-0.398	-0.225	1.000

Note. Panel A presents the Spearman's rank correlations among all major variables included in the model, using the full sample. Panel B and C present results for the non-pandemic and the pandemic periods, respectively.

The results indicate a weak positive correlation of 0.009 between credit rating revisions and ΔESG in Panel A. In Panel B, covering the non-pandemic period, the correlation is 0.004. In Panel C, which corresponds to the pandemic period, the correlation increases slightly to 0.042, though it remains weak.

Figure 2: *Distribution of Rating Revisions and ESG Changes Over Time*



Note. ESG changes are organized based on year-over-year score movements. Rating revisions include negative revisions, positive revisions, and stable ratings (no change), covering the period from 2015 to 2022.

Figure 2 illustrates the percentage of credit rating revisions, categorized as negative, positive, and no change, alongside the mean of ESG changes over time. The red solid line shows a peak of negative credit rating revisions in 2020, the year that the COVID-19 pandemic was officially declared, and a drop of no changes, depicted by dashed line, showing the impact of the crisis on credit ratings worldwide. This suggests that the Pandemic makes credit rating agencies adopt a more pessimistic approach, assigning lower credit ratings in response to the COVID-19 pandemic. Nevertheless, the number of firms with unchanged credit ratings increased significantly from 2020 to 2021, while the number of firms with negative credit rating revisions decreased, reflecting a less pessimistic reassessment by credit rating agencies in the second year of the pandemic. Notably, by 2022, the distribution of revisions across all three categories remained constant, suggesting that government recovery measures played a stabilizing role, mitigating the initial instability observed in 2020 and fostering a more controlled response in subsequent years of the pandemic crisis.

Additionally, Fig.2 illustrates the development in the mean of ΔESG over the period, showing that companies consistently improved their ESG scores. The average ΔESG shows an upward trend from 2018 to 2020. However, the slight decline in ΔESG in 2022 suggests a deceleration in the rate of improvement compared to prior years. This may reflect more stable investments in ESG following the significant adjustments made during the COVID-19 pandemic.

4.2 Moderating role of ESG change

In this section, we investigate the relationship between ESG changes and credit rating revisions. Table 4 presents Least Squares Dummy Variable (LSDV) regression models. Consistent

with prior research (Shanaev & Ghimire, 2022), we include industry and country fixed effects in models I to III to account for potential cross-industry and cross-country explanations. All models cluster standard errors at the firm level to account for within-firm correlations. The primary independent variable is the interaction between ESG changes (ΔESG) and the COVID-19 period dummy.

Table 4: *LSDV regression results*

	I	II	III
Variables	Credit Rating Revision	Credit Rating Revision	Credit Rating Revision
$Covid\ Pandemic_{i2020,2021}$	-0.188***		-0.360***
	(0.029)		(0.054)
ΔESG_{it}		-0.001	-0.007**
		(0.002)	(0.003)
$\Delta ESG_{it} * Covid\_Pandemic_{i2020,2021}$			0.024***
			(0.006)
$Ln(Revenue)_{it}$	0.022**	0.046**	0.045**
	(0.009)	(0.018)	(0.018)
$Cash_{it}$	-0.083	-0.212	-0.143
	(0.140)	(0.231)	(0.232)
$Leverage_{it}$	-0.556***	-0.780***	-0.777***
	(0.103)	(0.165)	(0.164)
$Beta_{it}$	-0.112***	-0.180***	-0.150***
	(0.030)	(0.050)	(0.050)
ROA_{it}	4.580***	4.919***	4.751***
	(0.445)	(0.560)	(0.555)
Country Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Adjusted R^2	0.101	0.118	0.127
Observations	14,416	6,672	6,672

Note. This table presents the coefficients and standard errors from the Least Squares Dummy Variable (LSDV) regressions for rating revision in Equation (1). We estimate the LSDV regression with industry and country fixed effects. The main sample (containing firms with ESG data) comprises 6,672 firm-year observations of 47 countries and 10 industries over the 2015–2022 period. Robust standard errors clustered at the firm-level are reported in parentheses. ∗∗∗, ∗∗, and ∗ denote significance levels at 1%, 5%, and 10%, respectively.

In Table 4, Model I, the estimated coefficient β_3 (-0.188***) indicates that credit rating revisions (with an average value of -0.349 before the pandemic) were on average 0.188 lower during the years 2020–2021, holding other variables constant. This result is consistent with previous studies (Acharya & Steffen, 2020) and suggests that the COVID-19 pandemic is associated with less favourable assessments by credit rating agencies of firms' economic and financial conditions. In contrast, Model II shows no statistically significant relationship between ΔESG and credit rating revisions over the 2015–2022 period.

In Model III, the estimated coefficient β_3 (0.024), which captures the moderating role of Δ*ESG* in the association between the *COVID-19 pandemic* and credit rating revisions, is positive and statistically significant at the 1% level. Using one standard deviation of Δ*ESG* (6.440) to assess the economic magnitude of the interaction term, the negative coefficient associated with the *COVID-19 pandemic* (-0.360) is, on average, reduced by 0.154 (0.024*6.440). This suggests that improvements in ESG practices mitigate the negative association between the pandemic period and credit rating revisions, but do not fully protect firms from downgrades, indicating that firms are not entirely "immunized" against negative revisions (Broadstock et al., 2021). As expected for models including interaction terms, the interaction exhibits a slightly higher VIF; however, the maximum VIF of 1.73 remains far below commonly accepted cutoffs, confirming that multicollinearity does not pose a threat to the empirical analysis.

Overall, the results indicate that the association between ESG and credit rating revisions depends on the context of the analysis. While changes in ESG scores are not directly associated with credit rating revisions over the full sample period, they exhibit a significant moderating role during the COVID-19 crisis. Consistent with prior literature, this moderating role of ESG changes may be attributed to sustainable firms' enhanced stakeholder relationships and ability to adapt to rapid changes in capital markets, fostering resilience during crises. This resilience and strengthened stakeholder trust provide a competitive advantage when confidence in corporations and markets declines (Ding et al., 2021; Lins et al., 2017).

The estimated coefficient on *Leverage* is negative and statistically significant at the 1% level, indicating that, on average, firms with higher leverage are associated with a greater tendency of receiving a downgrade. This result is consistent with leverage acting as a risk-amplifying factor. Additionally, the estimated coefficient on *Beta* is negative and significant at the 1% level. This finding suggests that, on average, higher equity risk, as captured by beta, is associated with lower creditworthiness. Consequently, firms with higher beta values are more likely to experience downgrades. Our findings align with the results in previous studies (Attig et al., 2013; Baker et al., 2022; Safiullah et al., 2021). Conversely, the estimated coefficient for *ln(Revenue)* is also positive

and significant at the 5% level, indicating that larger firms are, on average, more likely to receive higher credit rating revisions. The estimated coefficient on *ROA* is positive and statistically significant at the 1% level. The results indicate that companies with higher *ROA*, an index of profitability, are on average more likely to experience positive rating revisions. This suggests that credit rating agencies tend to upgrade firms that use their assets more efficiently to generate profits. Taken together, these results indicate that firm-level characteristics operate through credit risk channels, providing support to the validity of the empirical specification.

Equation (1) assigns numerical values to credit ratings, which are inherently ordinal variables. This approach may lead to the incorrect assumption that the differences between credit ratings are equidistant. For instance, transitioning from BBB- to BB+ marks a shift from investment grade to speculative grade, creating a more pronounced negative impact on a company's access to the debt market than a downgrade from AA to A. Additionally, we employed a probit model (Eq. 2) in our analysis, where rating revision is measured as a dummy variable, with a value of 1 indicating a negative rating revisions, ensuring analytical consistency (Attig et al., 2013; Baker et al., 2022). The results are presented in Table 5.

Table 5: *Probit regression results*

	I	II	III
Variables	Negative Rating Revisions	Negative Rating Revisions	Negative Rating Revisions
$Covid\ Pandemic_{i2020,2021}$	0.366***		0.509***
	(0.033)		(0.048)
ΔESG_{it}		0.001	0.004
		(0.003)	(0.004)
$\Delta ESG_{it} * Covid\_Pandemic_{i2020,2021}$			-0.014**
			(0.006)
$Ln(Revenue)_{it}$	-0.021	0.021	0.023
	(0.013)	(0.021)	(0.021)
$Cash_{it}$	-0.546**	-0.242	-0.358
	(0.217)	(0.264)	(0.273)
$Leverage_{it}$	0.874***	0.725***	0.726***
	(0.122)	(0.153)	(0.155)
$Beta_{it}$	0.058*	0.088**	0.035
	(0.032)	(0.041)	(0.042)
ROA_{it}	-3.863***	-4.035***	-3.874***

	(0.425)	(0.576)	(0.550)
Country Dummies	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
Pseudo R^2	0.2604	0.2305	0.248
Observations	14,408	6,664	6,664

Note. This table presents coefficients and standard error results of the probit model of 'Negative Rating Revision' in subsequent years. We estimate the probit model Equation (2), where the dependent variable '$Negative\ Credit\ Rating\ Revision_{i,t}$', represents a downgrade of firm '*i'* in year *'t'*. Negative Credit Rating Revision is a dummy variable (downgrade = 1; positive and no change = 0). The main sample (containing firms with ESG data) comprises 6,664 firm-year observations of 47 countries and 10 industries from 2015 to 2022. Robust standard errors clustered at the firm level are reported in parentheses. ∗∗∗, ∗∗, and ∗ denote significance levels at 1%, 5%, and 10%, respectively.

In Table 5, Model I shows a positive and statistically significant association at the 5% level between the COVID-19 pandemic and negative rating revisions during the years 2020 and 2021. Model III confirms that the estimated coefficient β_3 (-0.014**) reflects the moderating role of ΔESG in the association between the Covid-19 Pandemic and negative rating revisions. The coefficient is negative and statistically significant at the 5% level. This suggests that, on average, firms with positive ESG changes were less likely to receive negative rating revisions during the pandemic, corroborating the results in Table 4. This finding is consistent with the literature suggesting that stronger ESG practices are associated with firms' improved ability to manage and secure additional debt in challenging times (Chintrakarn et al., 2021; Ding et al., 2021; Lins et al., 2017).

The estimated coefficient on *Leverage* is positive and statistically significant at the 1% level, indicating that firms with high leverage are, on average, more likely to receive a downgrade. This result highlights leverage as a risk-amplifying factor, contributing to downgrades. In contrast the estimated coefficient on *ROA* is negative and statistically significant at the 1% level. The result suggests that companies with higher ROA, an index of profitability, are less prone to receive downgrades. These findings are consistent with those in Table 4 and align with the existing literature (Attig et al., 2013; Baker et al., 2022; Safiullah et al., 2021).

5 Discussion and Conclusion

To provide empirical insights into the role of ESG changes in credit rating revisions during the pandemic, our study uses a global sample of non-financial listed companies from 47 countries from 2015 to 2022. The COVID-19 pandemic, an exogenous event that differs from previous crises, had a widespread global impact (Augustin et al., 2022), offering an opportunity to

investigate firms' resilience to external challenges through a cross-country analysis. The growing importance of ESG practices in recent years and their effects on the corporate debt market underscore the relevance of examining this topic during the economic disruption caused by COVID-19.

The findings suggest that the COVID-19 pandemic was associated with downgrades in credit ratings. However, firms with positive ESG changes experienced less pronounced revisions, as credit rating agencies seem to perceive such changes as signals of risk mitigation. These results remain robust across multiple tests, providing evidence that improvements in ESG engagement are associated with reduced negative impacts on credit ratings. For instance, the results align with the view that ESG practices strengthen the relationship between firms and their stakeholders, enhancing resilience in capital markets during the pandemic. Stakeholders of firms with positive ESG changes appeared more willing to support the business, potentially improving profitability, gross margins, and sales growth, which may also enhance the firms' capacity to manage and obtain additional debt. This research contributes to the literature showing that ESG improvements are associated with firms' ability to navigate challenging times, such as the COVID-19 pandemic (Ding et al., 2021).

These results also have managerial implications. While the COVID-19 pandemic led to more credit rating downgrades, firms with positive ESG changes experienced less severe revisions, indicating that rating agencies perceive ESG improvements as signals of risk mitigation and resilience. From a managerial perspective, this suggests that enhancing ESG practices could help protect firms' credit profiles and access to debt markets during periods of economic stress, potentially by strengthening stakeholder relationships and supporting operational stability, profitability, and sales growth. However, these findings should be interpreted with caution, since identifying causal effects in this empirical framework remains challenging, even after a range of robustness checks. For instance, firms that enhance their ESG performance may already possess competitive advantages that are not captured by the included controls. In addition, firms with higher credit ratings could be more inclined to exhibit positive ESG changes, raising concerns about reverse causality.

Furthermore, our reliance on secondary data from the LSEG Workspace dataset implies the use of a single ESG rating provider. LSEG ESG scores are widely used in the academic literature and are constructed using a standardized data collection process. However, discrepancies in ESG scores across agencies may arise due to differences in information sets, interpretations, and methodological approaches (Christensen et al., 2022). Divergences in scope, measurement, and weighting are interconnected and further complicate the interpretation of differences within

the same ESG categories across agencies. Consequently, the low correlation between ESG scores from different data sources may lead to divergent conclusions across studies. Finally, the study does not explicitly control for cross-country differences in monetary policy, and the findings should therefore be interpreted within the limitations of the empirical specification.

Future research could examine ESG data from different rating agencies (e.g., MSCI, Kinder, Lydenberg, Domini (KLD), Sustainalytics, and S&P Global (RobecoSAM)) to determine whether different data sources produce consistent results. Additionally, future research could benefit from focusing on regions and industries that are more comparable in terms of economic structure and regulatory context, which would improve the comparability and help isolate the role of monetary policy from firm-level financial conditions.

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Appendix

Table A.1*: Distribution of firm-year observations by country*

Country	Freq.	Percent	Cum.
Argentina	37	0.55	0.55
Australia	62	0.92	1.47
Austria	13	0.19	1.66
Belgium	10	0.15	1.81
Brazil	124	1.84	3.65
Canada	335	4.97	8.62
Chile	24	0.36	8.98
China	1054	15.64	24.61
Colombia	8	0.12	24.73
Czech Republic	1	0.01	24.75
Denmark	14	0.21	24.96
Finland	19	0.28	25.24
France	152	2.26	27.49
Germany	114	1.69	29.18
Greece	7	0.10	29.29
Hong Kong	27	0.40	29.69
Hungary	2	0.03	29.72
India	57	0.85	30.56
Indonesia	86	1.28	31.84
Ireland; Republic of	4	0.06	31.90
Israel	7	0.10	32.00
Italy	38	0.56	32.57
Japan	2069	30.70	63.26
Korea; Republic (S. Korea)	49	0.73	63.99
Malaysia	7	0.10	64.09
Mexico	36	0.53	64.63
Netherlands	33	0.49	65.12
New Zealand	3	0.04	65.16
Norway	15	0.22	65.39
Peru	10	0.15	65.53
Philippines	2	0.03	65.56
Poland	11	0.16	65.73
Portugal	4	0.06	65.79
Qatar	2	0.03	65.82
Russia	60	0.89	66.71
Saudi Arabia	13	0.19	66.90
Singapore	17	0.25	67.15

Country	Freq.	Percent	Cum.
South Africa	34	0.50	67.66
Spain	59	0.88	68.53
Sweden	54	0.80	69.33
Switzerland	35	0.52	69.85
Taiwan	43	0.64	70.49
Thailand	218	3.23	73.72
Turkey	52	0.77	74.50
United Arab Emirates	2	0.03	74.53
United Kingdom	152	2.26	76.78
United States of America	1565	23.22	100.00
Total	6740	100.00	