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The effect of financial crisis on ESG performance

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Abstract

This study empirically investigates the impact of financial crises, particularly the Great Financial Crisis and the COVID-19 pandemic, on firms' Environmental, Social, and Governance (ESG) scores using data from companies across various global industries. Through Ordinary least squares (OLS) regression and Poisson regression models, the research explores whether these crises, along with economic system factors, influence firms' engagement in ESG practices. Contrary to expectations, the findings do not establish a significant relationship between financial crises and a decline in ESG practices. This possibly indicates firms' persistent commitment to ESG practices amidst economic challenges across diverse economic environments.

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Table of Contents

1 Introduction

In recent years, Environmental, Social, and Governance (ESG) criteria have gained significant traction in corporate practices, spurred by heightened awareness among stakeholders regarding their impact on sustainable development and long-term financial performance (Kuzey & Uyar, 2017). The ESG score, a metric ranging from 0.1 to 100, assesses factors such as emissions, environmental innovations in products, human rights practices, and corporate governance, with higher scores indicating stronger corporate social responsibility (CSR) engagement (D'Amato et al., 2021). These scores have emerged as pivotal indicators for evaluating organizational sustainability (Clément et al., 2022), reflecting a broader trend driven by growing stakeholder concerns over global environmental challenges. This trend has amplified the significance of sustainability disclosures and the consequential impact on firms' ESG scores (Alessa et al., 2024).

Research indicates that multiple factors significantly impact the ESG score of firms. According to legitimacy theory, companies must maintain their legitimacy within society to sustain operations (Şeker & Şengür, 2021). As a result, addressing public scrutiny becomes imperative for these firms. Literature suggests that more profitable firms face greater pressure to justify their actions (Gamerschlag et al., 2010; Rahman & Alsayegh, 2021). Furthermore, profitable corporations have the financial resources and capacity to bear the costs associated with enhancing the disclosure of ESG information to their stakeholders, thereby legitimizing their operations (Rahman & Alsayegh, 2021). Consequently, it is anticipated that firms exhibiting higher profitability will demonstrate superior ESG performance (Rahman & Alsayegh, 2021; Aydoğmuş et al., 2022). Additionally, literature states that firms with higher leverage tend to exhibit superior ESG performance (Crespi & Migliavacca, 2020; Broadstock et al., 2021). This perspective is substantiated by empirical evidence indicating that banks offer more favourable terms to firms that disclose substantial carbon risk information to investors (Weber, 2013; Herbohn et al., 2017). As a result, it is believed that firms with higher levels of leverage are more likely to undergo scrutiny from debtholders and may feel compelled to disclose more ESG information. This disclosure serves to demonstrate their legitimacy and provide assurance regarding the firm's financial stability (Rahman & Alsayegh, 2021). Furthermore, literature suggests that a company's size positively influences its ESG performance (Drempetic et al., 2019;

Crespi & Migliavacca, 2020; Amosh & Khatib, 2023; Rahman & Alsayegh, 2021). As stated before in the introduction, the underlying rationale is that larger firms encounter greater public scrutiny (Udayasankar, 2008; Rahman & Alsayegh, 2021). Consequently, these companies often leverage their ESG performance to justify their practices to a wider array of stakeholders (Drempetic et al., 2019). This hypothesis is supported by the observation that larger firms are subject to more intense external pressure regarding their ESG activities.

Beyond stakeholder pressures, financial incentives also motivate firms to adopt ESG practices. Participation in ESG activities serves as a means to communicate crucial information about a company to external parties (Schmitz & Schrader, 2013). Profitable firms, anticipating robust future earnings, are more inclined to invest in ESG initiatives compared to less profitable counterparts (Schmitz & Schrader, 2013). This strategic investment signals underlying profitability potential and can result in more favourable financing conditions (Schmitz & Schrader, 2013). Moreover, substantial ESG expenditures distinguish financially sound companies from those less capable of affording such endeavours (Schmitz & Schrader, 2013). Engaging in ESG practices further enables firms to differentiate their products or services, thereby gaining a competitive advantage over industry rivals (Song, 2023).

In addition to the incentives associated with investing in ESG projects, there are also significant costs involved. These costs are predominantly upfront in nature; for instance, transitioning to sustainable energy sources often requires substantial initial investments (Welsch & Ghoniem, 2023). Furthermore, sustainable projects must contend with competition from existing energy sources that boast lower operating costs (Welsch & Ghoniem, 2023). While the potential benefits of adopting ESG practices can be compelling for firms, they face significant barriers such as high upfront costs and the competitive advantage held by traditional, lower-cost assets. These factors often deter firms from committing to ESG initiatives, despite the potential long-term advantages. This is particularly critical given the increasing importance of sustainable development today. Choosing to adhere to past practices, often referred to as "grow now, clean up later," could have profound implications for the future, particularly in terms of climate destabilization (Ekins & Zenghelis, 2021). The failure to invest in more sustainable business practices now could lead to even greater costs in the future (Ekins & Zenghelis, 2021). Therefore,

while the immediate costs may seem daunting, the long-term consequences of delaying ESG investments underscore the urgent need for firms to prioritize sustainability in their strategic planning and operational decisions.

In addition to upfront costs, another significant challenge to firms' ESG engagement is the potential impact of financial crises. Existing research indicates that during economic downturns, firms often adopt defensive and conservative strategies (Cheney & McMillan, 1990). As a result, there is a concern that firms may reduce their commitment to ESG practices, viewing them as financially burdensome (Karaibrahimoglu, 2010). Scholars argue that in times of crisis, firms tend to scale back their involvement in ESG initiatives due to perceived financial constraints and a defensive mindset. This defensive approach towards sustainability could jeopardize long-term ESG goals. Based on these observations, the study has formulated the following hypothesis: "Hypothesis 1: Firms tend to reduce their engagement in ESG practices during and following a financial crisis, which results in lower ESG scores during and after the financial crisis period."

Furthermore, literature indicates differences in financial system structures, with bank-based systems being characterized by intermediary roles of banks managing transactions and risks closely with clients, while market-based systems see capital flowing directly from savers to borrowers (Bats & Houben, 2020). Research suggests that bank-based systems may experience more severe financial crises due to misallocation of credit during booms and excessive restriction during downturns (Pagano et al., 2014; Bats & Houben, 2020, Gambacorta et al., 2014). Consequently, firms operating within bank-based financial systems are more likely to adopt a defensive strategy during a financial crisis due to their heightened sensitivity to the adverse impacts of such crises. Therefore it could be argued that since firms in bank-based economies are more sensitive to the negative consequences of a financial crisis, they are more likely to decrease their engagement in ESG practices. Therefore the following hypothesis has been formulated:
"Hypothesis 2: During and following a financial crisis, firms originating from bank-based economies are more likely to decrease their engagement in ESG practices compared to firms originating from market-based economies. Consequently, firms from bank-based economies are expected to exhibit lower ESG scores during and after a financial crisis in comparison to firms from market-based economies."

This study aims to explore whether there is empirical evidence indicating a decline in firms ESG performance during and after financial crises, and whether such effects vary between bank-based and market-based economies. By exploring this, the study aims to bridge the gap between financial performance and ESG engagement, especially in the context of economic instability. The potential existence of such declines could potentially justify governmental intervention aimed at ensuring firms uphold their ESG commitments. Maintaining steadfast dedication to ESG practices during financial crises is crucial for the continuity of long-term ESG objectives. Firms may respond by implementing crisis-specific sustainability strategies or adjusting reporting frameworks in turbulent economic times to sustain their focus on ESG goals. These measures play a critical role in prioritizing sustainability amid challenging economic conditions, thereby reinforcing corporate resilience and advancing broader sustainability agendas. By examining potential differences in the impact of financial crises on ESG performance between market-based and bank-based economies, policymakers can gain insights into the need for tailored regulations. For instance, if firms in bank-based economies exhibit a more pronounced decrease in ESG investment during and after crises compared to those in market-based economies, policymakers may consider implementing stricter regulations to maintain ESG investments in bank-based economies. This comparative analysis can inform policy decisions aimed at fostering ESG practices across diverse economic environments, ensuring that firms continue to prioritize sustainability amidst varying degrees of economic instability.

The study categorizes both the Great Financial Crisis and the COVID-19 crisis as financial crises. Despite the differing causes of these two events, they exhibit several notable similarities, as noted by Foroni et al. (2022). These similarities justify the classification of the COVID-19 crisis alongside the Great Financial Crisis within the framework of financial crises. This study employs empirical data from the LSEG workspace to investigate the impact of financial crises on firms ESG scores. Using a sample of companies across various industries worldwide, the study utilizes Ordinary least squares (OLS) regression and Poisson regression models. These models incorporate dummy variables to analyze different crisis periods—specifically, the Great Financial Crisis and the COVID-19 pandemic—while controlling for variables such as profitability, leverage, firm size, and the distinction between bank-based and market-based economies. The research aims to

uncover how financial crises influence firms' engagement in ESG practices, contributing insights into the resilience of ESG efforts across economic systems and periods.

Despite encountering challenges during these economic downturns, the findings indicate a consistent upward trend in average ESG scores over time, reflecting firms' sustained commitment to ESG practices. The study suggests that despite the obstacles posed by financial crises, firms across diverse economic systems maintain a steadfast dedication to implementing and improving their ESG initiatives.

The rest of the paper is organized as follows. Section 2 describes the data sample and elaborates on the research approach used in this study. Section 3 discusses the empirical results. Finally, section 4 summarizes the paper, discusses its implications, and addresses the limitations of the study.

2 Data & Methodology

The data was extracted from the LSEG workspace. The measure of the engagement in ESG practices is the ESG score. The ESG score, a metric ranging from 0.1 to 100, assesses factors such as emissions, environmental innovations in products, human rights practices, and corporate governance, with higher scores indicating stronger sustainability engagement (D'Amato et al., 2021).

This study focuses on evaluating the influence of financial crises on ESG performance, thus firms that did not disclose their ESG data during crisis and post-crisis periods are excluded from the data sample used in this study. This exclusion criterion resulted in a final sample size of 439 companies, which maintained the same average characteristics as the initial sample prior to the exclusion of firms with missing data. This methodological approach was deemed appropriate and justified for ensuring the integrity and reliability of the research findings. The analyzed dataset includes firms from a wide range of industries, encompassing trade and services, technology, real estate and construction, manufacturing, life sciences, finance, energy and transport, and applications and services. The data consist of countries all around the world. Based on the literature, the countries are divided into a category bank-based economy and a category market-based economy. In literature, countries such as Austria, Germany, Belgium, France, Italy, Finland, Norway, Greece, Japan, Switzerland, Spain, and Taiwan are categorized as bank-based economies (Baubeau, 2014; Levine, 2002; Benito, 2003). Conversely, nations including New Zealand, the Netherlands, South Korea, Denmark, Ireland, Canada, Australia, Great Britain, Hong Kong, the United States, Israel, Mexico, Sweden, and Brazil are classified as market-based economies (Baubeau, 2014; Amdur et al., 2011; Demirgüç-Kunt & Levine, 2001). This study uses the same classification of countries that is stated above.

This study examines two significant financial crises: the Great Financial Crisis and the COVID-19 pandemic. A notable limitation of this research is the scarcity of global financial crises occurring during periods when ESG scores were in widespread use. Consequently, this study juxtaposes the COVID-19 crisis alongside the Great Financial Crisis to analyze the effect of

financial crises on ESG scores. Despite the distinct causes of the Great Financial Crisis and the COVID-19 pandemic, they exhibit several similarities. Both crises escalated uncertainty levels, leading to negative impacts on real economic activity (Foroni et al., 2022). Moreover, both events entailed substantial demand and supply shocks, making the COVID-19 crisis the most comparable event to the Great Financial Crisis (Foroni et al., 2022). Therefore both crises are operationalized as financial crisis in this research. For the Great Financial Crisis, the study defines 2008 and 2009 as the crisis period, and 2010 and 2011 as the post-crisis period. In contrast, the COVID-19 crisis period spans 2020 and 2021, stemming from the emergence and global spread of the COVID-19 virus, with 2022 as the post-crisis period.

The objective of this research is to investigate the influence of a financial crisis on ESG performance. In the study a multiple regression model is employed for an OLS estimator, also incorporating dummies for the period during a financial crisis and after the crisis to capture its effect on the ESG score. Given the three distinct measurements of financial crisis and post-financial crisis periods, three separate models are used for the OLS regression analysis:

The General crisis model, represented by Model (1):

$$
\begin{aligned}
&ESGSCORE_i \\
&= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i \\
&+ \beta_6 CRISISDUMMY_i + \beta_7 POCRISISDUMMY_i + \beta_8 (Year * CRISISDUMMY)_i \\
&+ \beta_9 (Year * CRISISDUMMY * BankBased)_i + \beta_{10} (Year * POCRISISDUMMY)_i \\
&+ \beta_{11} (Year * POCRISISDUMMY * BankBased)_i + \epsilon_i
\end{aligned}
$$

The Great financial crisis model, represented as Model (2):

$$
\begin{aligned}
&ESGSCORE_i \\
&= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i + \beta_6 GFCD_i \\
&+ \beta_7 POGFC_i + \beta_8 (Year * GFCD)_i + \beta_9 (Year * GFCD * BankBased)_i + \beta_{10} (Year \\
&* POGFC)_i + \beta_{11} (Year * POGFC * BankBased)_i + \epsilon_i
\end{aligned}
$$

The COVID-19 crisis model, represented by Model (3):

$$
\begin{aligned}
&ESGSCORE_i \\
&= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i \\
&+ \beta_6 COVIDD_i + \beta_7 POCOVIDD_i + \beta_8 (Year * COVIDD)_i \\
&+ \beta_9 (Year * COVIDD * BankBased)_i + \beta_{10} (Year * POCOVIDD)_i \\
&+ \beta_{11} (Year * POCOVIDD * BankBased)_i + \epsilon_i
\end{aligned}
$$

In these models profitability is measured by return of assets, which is calculated by dividing the company's net income by its total assets. Leverage is defined as the total debt to the total capital ratio. The firm's size is defined as the natural logarithm of the firm's total assets. The year variable in this study denotes distinct calendar years. The distinction between firms originating from market-based versus bank-based economies is captured by the BankBased dummy variable. Specifically, the BankBased dummy variable takes the value of 1 to indicate firms originating from bank-based economies, and 0 to denote firms originating from market-based economies.

The measurement of the financial crisis in the study is captured through three distinct sets of dummy variables, each representing different periods and types of crises. First, there are general crisis and post-crisis dummies that encompass both the Great Financial Crisis and the COVID-19 crisis periods. The general crisis dummy (CRISISDUMMY) is assigned a value of 1 for the years 2008, 2009, 2020, and 2021, and a value of 0 for all other years. The general post-crisis dummy (POCRISISDUMMY) takes a value of 1 for the years 2010, 2011, and 2022, and a value of 0 for all other years. For the Great Financial Crisis specifically, the main variable of interest is represented by a dummy variable (GFCD) that takes a value of 1 for the years 2008 and 2009, indicating the crisis period. Additionally, the post-crisis dummy variable (POGFCD) takes a value of 1 for the years 2010 and 2011, and 0 for all other years in the sample period. For the COVID-19 crisis, the main variable of interest is represented by a dummy variable (COVIDD) that takes a value of 1 for the years 2020 and 2021, indicating the crisis period. It takes a value of 0 for the other years in the sample. Additionally, the post-crisis dummy variable (POCOVIDD) takes a value of 1 for the year 2022 and 0 for all other years in the sample period. These dummy variables allow for a detailed examination of the impact of both the Great Financial Crisis and the COVID-19 crisis, as well as their respective post-crisis periods, on the variables of interest in the regression models.

The models included four distinct interaction terms to analyze the dynamics of ESG scores in relation to financial crises and economic systems. The first interaction term involved the variable 'year' and a crisis dummy. This was implemented to determine whether the upward trend in ESG scores over the years differs during financial crises. The second interaction term combined post-crisis dummies with the year variable. This was constructed in order to assess whether the upward trend in ESG scores changes following financial crises. In the third interaction term, bank-based dummies were interacted with both the year variable and the financial crisis dummy. This was done to examine whether the impact of a financial crisis on ESG scores, and consequently on a firm's ESG engagement, varies between market-based and bank-based economies. The fourth interaction term involved bank-based dummies, the year variable, and the post-crisis dummy. This aimed to investigate whether the effect of a financial crisis on ESG scores differs between bank-based and market-based economies after the crisis period.

A Poisson regression is employed as an alternative to the OLS regression to model the ESG score, which ranges from 0 to 100. This approach is justified by the characteristic of the ESG score resembling count data. Poisson regression allows for assessing the percentage change in the expected ESG score. Given the presence of three distinct measures of financial crises, three separate Poisson regression models are utilized:

The General crisis model, represented by Model (4):

$$ln(Y_i) = \ln(\mathrm{E}(\frac{Y_i}{X_i})) = \ln(\lambda_i)$$
$$= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i$$
$$+ \beta_6 CRISISDUMMY_i + \beta_7 POCRISISDUMMY_i + \beta_8 (Year * CRISISDUMMY)_i$$
$$+ \beta_9 (Year * CRISISDUMMY * BankBased)_i + \beta_{10} (Year * POCRISISDUMMY)_i$$
$$+ \beta_{11} (Year * POCRISISDUMMY * BankBased)_i + \epsilon_i$$

The Great financial crisis model, represented as Model (5):

$$ln(Y_i) = \ln(\mathrm{E}(\frac{Y_i}{X_i})) = \ln(\lambda_i)$$
$$= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i + \beta_6 GFCD_i$$
$$+ \beta_7 POGFC_i + \beta_8 (Year * GFCD)_i + \beta_9 (Year * GFCD * BankBased)_i + \beta_{10} (Year$$
$$* POGFC)_i + \beta_{11} (Year * POGFC * BankBased)_i + \epsilon_i$$

The COVID-19 crisis model, represented by Model (6):

$$ln(Y_i) = \ln(\mathrm{E}(\frac{Y_i}{X_i})) = \ln(\lambda_i)$$
$$= \beta_0 + \beta_1 Profitability_i + \beta_2 Year_i + \beta_3 Leverage_i + \beta_4 Size_i + \beta_5 BankBased_i$$
$$+ \beta_6 COVIDD_i + \beta_7 POCOVIDD_i + \beta_8 (Year * COVIDD)_i$$
$$+ \beta_9 (Year * COVIDD * BankBased)_i + \beta_{10} (Year * POCOVIDD)_i$$
$$+ \beta_{11} (Year * POCOVIDD * BankBased)_i + \epsilon_i$$

In the models presented above, $\ln(Y_i)$ represents the natural logarithm of the expected count of the ESG score.

3 Empirical Findings

3.1 Ordinary least squares Regression

Figure 1 illustrates a consistent downward trend in average ESG scores in bank-based economies over the years. In contrast, the average ESG scores in market-based economies show a slight increase. This development in ESG scores for market-based economies aligns closely with the narrative outlined in the introduction. This effect is also evident in the regression results, as the year variable is positively significant across all OLS models. The relationships of the control variables with ESG scores generally align with findings from previous research. Specifically, profitability and firm size are significantly positively related to a firm's ESG score. However, the relationship between leverage and ESG score is not found to be significant.

The primary focus of this research is on the interaction terms that are included in the models. The first model, which incorporates both the Great Financial Crisis and the COVID-19 crisis as indicators of financial crises, reveals significant findings regarding these interaction terms. The interaction term between the year variable and the CRISISDUMMY is significantly negative. This suggests that during financial crises, firms' engagement in ESG practices diminishes, leading to lower ESG scores. Furthermore, this effect persists in the post-crisis period, as indicated by the significantly negative interaction term between the year variable and the POCRISISDUMMY. Regarding the other interaction terms in the model, neither the interaction between the year variable, the CRISISDUMMY, and the BankBased dummy, nor the interaction between the year variable, the POCRISISDUMMY, and the BankBased dummy are statistical significant. This indicates that the origin of a firm in either a bank-based or market-based economy does not influence its engagement in ESG practices during and after a financial crisis. Consequently, this does not result in lower ESG scores during and after such periods.

Model 2 focusses specifically on the Great Financial Crisis. The results concerning the Great Financial Crisis indicate no evidence that firms reduced their engagement in ESG practices during or after this period. Both the interaction term between the Great Financial Crisis Dummy (GFCD) and the year variable, and the interaction term between the post Great Financial Crisis Dummy (POGFC) and the year variable are found to be insignificant. Additionally, there is no

significant relationship between the type of economy from which a firm originates and the effect of the Great Financial Crisis on the firm's engagement in ESG practices, as the relevant interaction terms are also found to be insignificant.

With respect to the COVID-19 crisis, the results in Table 1 show similar outcomes to those for the Great Financial Crisis. In Model 3, neither the interaction terms between the COVID-19 Dummy (COVIDD) and the year variable, nor the interaction term between the Post-COVID-19 Dummy (POCOVIDD) and the year variable, are found to be statistically significant. This indicates that there is no significant reduction in firms' ESG practices during or after the COVID-19 crisis. Additionally, there is no significant relationship between the type of economy from which a firm originates and the effect of the COVID-19 crisis on the firm's engagement in ESG practices, as the relevant interaction terms are also found to be insignificant. The calculation of the interaction terms between the Post-COVID-19 Dummy (POCOVIDD) and the year variable, as well as between the POCOVIDD, year variable, and BankBased variable, resulted in NA due to singularity. This issue is further addressed in the conclusion section.

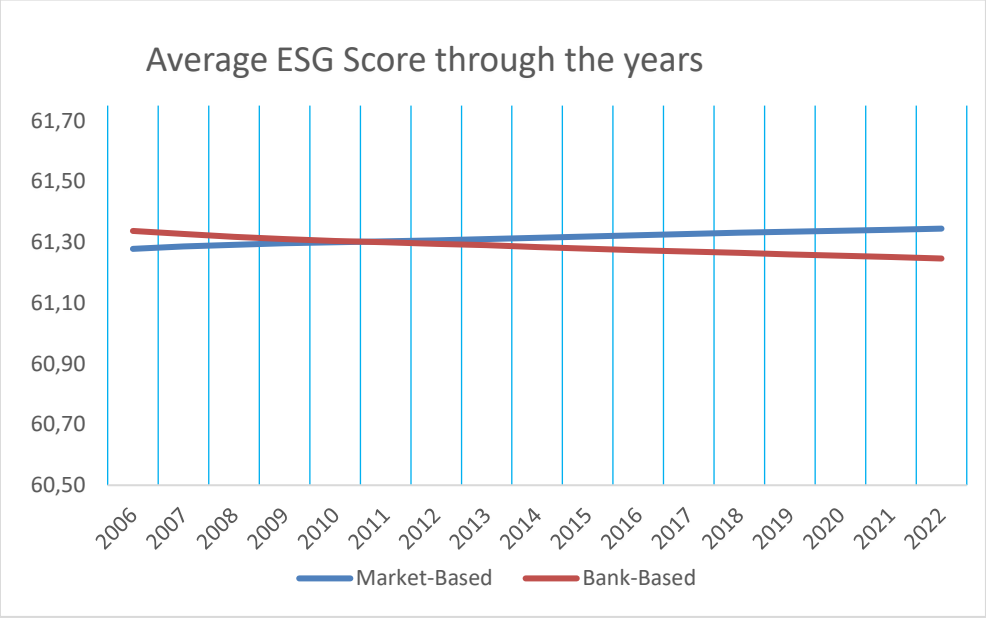

Figure 1. Average development of ESG scores in a bank and market-based economy.

Table 1. Ordinary least squares regression results of ESG score.

ESG Score	Model 1	Model 2	Model 3
Intercept	-3614.0*** (143.6)	-3209.0*** (109.7)	-3068.0*** (125.5)
Year	1.801*** (0.0713)	1.600*** (0.0545)	1.531*** (0.0624)
Profitability	0.1421*** (0.0230)	0.1367*** (0.0229)	0.1312*** (0.0231)
Size	2.610*** (0.0912)	2.605 *** (0.0914)	2.606*** (0.0917)
Leverage	0.000974 (0.001051)	0.001008 (0.001053)	0.000929 (0.001057)
BankBased	-169.2 (248.7)	-127.6 (189.8)	-251.2 (217.4)
Crisis indicator	1283*** (212.3)	-2705 (2662.0)	3629*** (2695.0)
Post-crisis indicator	1763 *** (246.0)	-169.7 (2662.0)	-4.149*** (1.138)
*(Crisis indicator*Year)*	-0.6362*** (0.1054)	1.349 (1.325)	-1.797 (1.334)
*(Crisis indicator *Year*BankBased)*	0.05130 (0.1825)	1.092 (2.296)	0.008348 (2.304)
*(Post crisis dummy variable *Year)*	-0.8744*** (0.1221)	0.08672 (1.324)	NA
*(Post crisis dummy variable *Year*BankBased)*	000.7045 (0.2116)	0.3037 (2.296)	NA
No of Observations	7460	7460	7460
R-Square Overall	0.2716	0.2685	0.2632
F-test	198.3	195.2	221.7

Notes: These are notes applicable to the table. *** Significant the at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. The standard errors are standing between the brackets. For Model 1, the crisis indicator is CRISISDUMMY, and the post-crisis indicator is POCRISISDUMMY. For Model 2, the crisis indicator is GFCD, and the post-crisis indicator is POGFC. For Model 3, the crisis indicator is COVIDD, and the post-crisis indicator is POCOVIDD.

3.2 Poisson regression

In addition to the OLS regression, a Poisson regression is employed. Table 2 presents the results of the Poisson regression used in this study. The results of Model 4 suggest that firms reduce their engagement in ESG practices during and after a financial crisis. This is indicated by the significantly negative interaction terms between the year variable and the CRISISDUMMY, as well as between the year variable and the POCRISISDUMMY. Furthermore, the interaction terms between the year variable, CRISISDUMMY, and the BankBased variable, as well as between the year variable, POCRISISDUMMY, and the BankBased variable, are not statistically significant. This indicates that there is no significant relationship between the type of financial system in which a firm originates and the effect of a financial crisis on its engagement in ESG practices.

The results of the analysis focusing on specific crises reveal different outcomes. The interaction term between the year variable and the Great Financial Crisis Dummy (GFCD) is positively significant, indicating that firms increased their engagement in ESG practices during the Great Financial Crisis. However, the interaction term between the year variable and the Post-Great Financial Crisis Dummy (POGFC) is not significant. Consistent with the findings from Model 4, whether a firm originates from a bank-based or market-based economy does not influence the impact of the Great Financial Crisis on the firm's sustainability behavior. This is evidenced by the lack of statistical significance in the interaction terms involving the GFCD and POGFC with the year variable and the BankBased variable.

The results from Model 6 indicate that firms reduced their engagement in ESG practices during the COVID-19 crisis, as evidenced by the statistically negative interaction term between the year variable and the COVIDD variable. Moreover, the engagement in ESG practices during the COVID-19 crisis is not influenced by the type of economy from which the firm originates.
However, the calculation of the interaction terms between the Post-COVID-19 Dummy (POCOVIDD) and the year variable, as well as between the POCOVIDD, year variable, and BankBased variable, resulted in NA (Not Available) due to singularity. This issue will be discussed further in the conclusion section of the study.

Table 2. Poisson regression results of ESG score.

ESG Score	Model 4	Model 5	Model 6
Intercept	-62.50*** (1.241)	-52.28*** (0.9188)	-50.82*** (1.034)
Year	0.03270*** (0.0006162)	0.02762*** (0.0004561)	0.02691*** (0.0005142)
Profitability	0.002198*** (0.0001815)	0.002090*** (0.0001813)	0.002054*** (0.0001825)
Size	0.04024*** (0.0006162)	0.04014 *** (0.0006974)	0.04019*** (0.0006975)
Leverage	0.00001576 (0.000008169)	0.00001659* (0.0000008197)	0.00001495 (0.000006975)
BankBased	3.842 (2.077)	3.449* (1.539)	1.209 (1.738)
Crisis indicator	27.10*** (1.770)	-55.15 (22.76)	63.46** (20.22)
Post-crisis indicator	36.09 *** (1.991)	-4.077 (22.02)	-0.08381*** (0.008673)
*(Crisis indicator*Year)*	-0.01344*** (0.0008783)	0.02750 * (0.0133)	-0.03143 ** (0.01001)
*(Crisis indicator *Year*BankBased)*	0.002179 (0.001475)	0.01664 (0.01908)	0.001707 (0.01681)
*(Post crisis dummy variable *Year)*	-0.01790*** (0.0009883)	0.002072 (0.01095)	NA
*(Post crisis dummy variable *Year*BankBased)*	0.001902 (0.001662)	0.004919 (0.01846)	NA
No of Observations	7460	7460	7460

Notes: These are notes applicable to the table. *** Significant the at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. The standard errors are standing between the brackets. For Model 4, the crisis indicator is CRISISDUMMY, and the post-crisis indicator is POCRISISDUMMY. For Model 5, the crisis indicator is GFCD, and the post-crisis indicator is POGFC. For Model 6, the crisis indicator is COVIDD, and the post-crisis indicator is POCOVIDD.

4 Conclusion

This study aims to contribute to the existing literature by providing empirical evidence on the impact of financial crises on firms' ESG scores. Initially, the findings highlight a general decline in ESG practices during and after such periods, aligning with the premise of hypothesis 1. However, specific analyses focusing on the individual financial crises show no significant reduction in ESG practices during or after both the Great Financial Crisis and the COVID-19 crisis in certain models, thereby challenging the assumptions put forth by Hypothesis 1. The type of financial system—whether bank-based or market-based—does not significantly alter this dynamic, challenging the assumptions of Hypothesis 2. The analysis reveals a consistent upward trend in average ESG scores over the years, with profitability and firm size positively influencing ESG scores, while leverage remains insignificant. This upward trend supports the notion that firms increasingly adopt ESG practices. In conclusion, the study reveals that while financial crises pose challenges to corporate ESG efforts, the general trend of increasing ESG scores over time reflects a long-term commitment to ESG practices. This study does not present a clear statistically significant result indicating that financial crises negatively impact ESG engagement, suggesting that ESG engagement is resilient to financial crises and that this dynamic doesn't differ across different economic systems. The resilience observed across different economic systems highlights the robustness of ESG engagement, pointing to potential areas for future research to explore the mechanisms driving this resilience and the specific impacts of different types of financial crises on ESG activities.

Several limitations must be addressed. As noted in the methodology section, data was initially collected only for firms that disclose their ESG scores. This exclusion of firms that do not disclose their ESG scores could impact the regression outcomes and the study's conclusions. Next to this, firms with missing ESG scores data during the periods surrounding the Great Financial Crisis and the COVID-19 crisis were also excluded from the sample. This exclusion could also affect the research outcomes and the generalizability of the results. The calculation of certain interaction terms related to the COVID-19 period resulted in singularities, suggesting the need for further investigation into this period. This issue is likely due to the fact that the post-crisis period for the COVID-19 crisis in this research was only one year (2022), whereas the other periods

examined in the research were at least two years long. This discrepancy arose because ESG scores were scarcely available for the years following 2022. Therefore, future research should extend the post-crisis period for the COVID-19 crisis to at least two years, once more ESG scores become available for the years beyond 2022. Additionally, the categorization of countries as either bank-based or market-based has certain limitations. As discussed in the methodology section, countries are classified as either bank-based or market-based for the purposes of this study. However, as noted by Levine (1999), making a clear distinction between bank-based and market-based systems is challenging due to the various methods available for categorizing countries. Furthermore, Levine (1999) indicates that there are more categories beyond just bank-based and market-based, such as underdeveloped systems. Future research should consider incorporating additional categories to capture the diversity of financial systems more accurately. Lastly, the reliability and validity of the findings are uncertain due to significant standard errors with certain coefficients and a relatively low R-squared. Moreover, the consistently significant negative intercept across the models suggests potential issues. Thus, future research should consider alternative methods and models to enhance the reliability and validity of the results.

This study contributes to the literature by empirically investigating whether financial crises lead to a reduction in firms' engagement in ESG practices. Despite challenges observed during such economic downturns, the study reveals a consistent upward trend in average ESG scores over time, including during periods of financial crisis, highlighting firms' enduring dedication to ESG practices. This suggests that government intervention or changes in company strategies are not needed to maintain engagement in ESG practices during economic instability. This consistency is observed across different financial systems. The resilience demonstrated in ESG efforts across diverse economic systems suggests that, despite the obstacles presented by financial crises, firms maintain a steadfast commitment to ESG practices. Future research avenues could explore the mechanisms that underpin this resilience, and examine how different types of financial crises specifically impact firms' ESG activities in nuanced ways.

5 References

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