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Social capital, trust, and bank tail risk: The value of ESG rating and the effects of crisis shocks

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ABSTRACT

Using a global sample of 244 banks in 52 stock markets, we investigate the effect of corporate social responsibility (CSR) on bank tail risk in normal and turbulent times. Our analysis shows no significant evidence that CSR intensity protects banks from tail risks *ex ante* or *during* the global financial crisis of 2007–2009. However, investors appear to become more tolerant and more lenient towards banks with stronger CSR *post ante* economic recession by reducing the likelihood of extreme devaluation of banking stocks. Socially responsible banks with higher social capital and trust (associated with superior CSR performance) experience lower idiosyncratic and systematic tail risks even in the context of the COVID-19 pandemic in 2020. Our empirical evidence implies that the trust between banks and investors started to build through banks' investments in social capital through committed CSR performance since the credit crunch erupted.

1. Introduction

Following the financial crisis, many corporations have emphasised the importance of a firm's social capital, driven by its CSR investments, in rebuilding stakeholder trust. However, the practitioner view that CSR helps build trust predates the financial crisis.

– Fitzgerald (2003), cited in Lins, Servaes and Tamayo (2017, p. 1786).

The global financial crisis (2007–2009) and the breakout of the COVID-19 pandemic have highlighted the value of social capital and trust for the stability of global financial sectors. It is recognised that the lack of mutual trust and public confidence might lead to economic backwardness, whereas higher social trust is associated with healthier economic development, especially in societies with greater social capital (Fukuyama, 1995). A growing literature has documented evidence regarding the positive association between trust, social capital, and stock market participation (Guiso et al., 2004, 2008). More recent studies by Amiraslabu et al. (2017) and Lins et al. (2017) demonstrate that firms with superior social capital derived from CSR intensity tend to exhibit higher stock returns, enhanced profitability, and continued growth during crisis periods (e.g., the Enron and WorldCom fraud scandals in 2001, and financial crisis in 2007–2009) (see Azmi et al., 2021; Chiaramonte et al., 2022; Li et al., 2022). In the current study, we extend this stream of research by presenting robust evidence that investments in social capital through intensified CSR activities help improve the trustful relationships between banks and their stakeholders and thereby prevent banking firms from tail risk, which implies dramatic stock price drops resulting in deterioration of future market performance.

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Social capital is a widely known concept encompassing trust and cooperative norms (Scrivens and Smith, 2013); therefore, identifying a straightforward measurement for social capital is difficult. However, as claimed in recent studies (Amiraslani et al., 2022; Lins et al., 2017), CSR performance can serve as an ideal proxy for the social capital of a firm. We follow this literature that banks' CSR activities can engender social capital and trust among stakeholders. We investigate the effect of bank CSR, bank tail risk, which is defined as the aggressiveness of bank risk-taking (Bushman et al., 2018), more specifically, the likelihood of extreme declines in a bank's stock price (Cohen et al., 2014; Diemont et al., 2016). Tail risk has been one of the crucial concerns of bank investors and regulators, especially when the banking system is exposed to exogenous shocks such as the emergence and crisis times. The banking industry plays a fundamental role in ensuring the health and sustainability of a nation's whole financial and economic systems. Therefore, a 'megaquake' in bank value and its domino effects are prone to jeopardise the entire system and warrant extensive focus from academic researchers and practitioners.

In recent decades, the increasingly globalized financial markets have caused banks to internationalize their operations, raising critical concerns about bank risk (Cetorelli and Goldberg, 2012). Internationalization is viewed as a source of diversification that can help mitigate bank riskiness levels (Amihudet al., 2002; Laeven and Levine, 2007). However, due to the global financial crisis, the contagion of risk across borders gained prominence, promoting heated debates on the effectiveness of bank internationalization (Berger et al., 2017). Buch et al. (2013, pp. 1401) offer another view that "large, internationally active banks may enjoy too much market power and bank internationalization may increase bank risk". Such a positive association between bank internationalization and risk has been empirically assessed by Berger et al. (2017). The positive relationship could be due to underlying channels such as foreign exchange risk (Brimmer and Dahl, 1975), local culture (Li and Guisinger, 1992), and the degree of legal and regulatory complexity (Alibux, 2007). Among the risks facing banking firms, tail risk is significant in practice owing to several reasons in combination: (1) tail risk is contagious nationally and globally (Berger et al., 2017), (2) it can potentially lead to bank crash (Bushman et al., 2018), and (3) it can affect the fundamentals of national and global financial stability, economic growth, and business cycle fluctuations (Berger et al., 2017; Laeven and Levine, 2009).

Drawing on the moral capital theory (Godfrey, 2005), we conjecture that superior CSR performance can diminish the risk of extreme stock market returns since it can generate and enhance the trust and confidence of CSR-oriented investors towards banks' operations. Prior studies have provided strong evidence that socially responsible firms aim to maximise shareholders' welfare through activities relevant to a broader range of nonfinancial stakeholders (including customers, employees, clients, the local community, and the environment) and a sustainable corporate governance mechanism. There is also ample evidence regarding the positive correlation between CSR, financial performance, and equity returns (e.g., Orlitzky et al., 2003; Margolis et al., 2010). However, there is a dearth of research on the CSR-tail risk nexus from a market-based perspective.

To our best knowledge, only one study (Diemont et al., 2016) examines the association between CSR and downside equity tail risk. By focusing on equities data for all nonfinancial firms from 2003 to 2011, the authors find a causal relationship between certain aspects of CSR and downside tail risk, and they call for more in-depth critical analysis in this field. We extend their study in two ways. First, our study utilises the environmental, social, and governance (ESG) rating scores while identifying the impacts of banks' systematic and idiosyncratic tail risk (in contrast to industrial firms in previous literature) for a global sample for an extended period from 2002 to 2020. This period encompasses the effects of two global evidential shocks, specifically, the financial and health crises caused by the COVID-19 pandemic. As such, our empirical investigations cover two main periods (i.e., post-2010 and pre-2010) to offer more recent and comprehensive evidence on whether the social capital and trust derived from superior CSR activities could pay off when external exogenous shocks occur.

Second, our research extends the previous study to consider the impact of the ongoing COVID-19 pandemic. This study is among the first attempts to combine topical research areas of CSR and tail risk under different economic and social conditions. Specifically, we examine the association between a bank's CSR performance and its extreme negative equity returns during turbulent and normal times. In our study, we argue that socially responsible banks with higher ESG scores tend to exhibit a lower possibility of suffering from large negative losses (i.e., lower tail risk). Banks with better CSR performance could create more trust and faith for investors because of their 'good and ethical doings'; therefore, investors are less vulnerable and more generous and tolerant regarding bank-specific events that negatively affect stock prices. Accordingly, socially responsible banks are less likely to suffer from extreme stock devaluations even in the period of a market crash crisis.

Our research covers a cross-country panel sample of 2,481 bank-year observations consisting of 244 banks listed in 52 stock markets (countries). We utilise two different estimation periods: pre-2010 (which is further split into the pre-crisis 2002–2006 and mid-crisis 2007–2009) and post-2010 (i.e., 2010–2020). The findings presented in this study are threefold. First, we find no significant association between bank CSR and tail risk in the pre-2010 period (i.e., before and during the 2007–2009 global financial turmoil). Nevertheless, a significantly negative CSR–tail risk relationship is observed for the post-crisis period (i.e., 2010–2020), suggesting that CSR-proactive banks are exposed to lower tail risk, and their stock values are significantly reduced. To a large extent, this finding implies that, after the financial crisis, market participants (i.e., investors) seem to have prioritised CSR as a critical non-financial indicator which positively affects the bank value and eventually enhances investors' relational wealth. As a reward for the bank's ethical and responsible activities, investors are more lenient towards firms in the event of unfavourable corporate outcomes or external market shocks, leading to a lower likelihood of extreme stock devaluation. Furthermore, we also find that this positive effect of CSR in reducing bank tail risk remains similar across non-COVID and COVID periods. This finding further highlights the importance of banks' ethical conduct in the eyes of the stakeholders. In particular, amid market disruptions in which the explicit wealth of stockholders is likely to be jeopardised, financial goals might become the sole priority for banks. Nevertheless, CSR activities adopted by banks are still considered and pay off in terms of less harsh stock market devaluation (i.e., lower tail risk).

In our empirical findings, the negative impacts of ES ratings are observed for both idiosyncratic and systematic tail risk. Both tail risk elements have implications for stock pricing, particularly a higher required premium for higher tail risk, despite the undiversified nature of the former. Furthermore, idiosyncratic tail risk is borne by banks, which makes it closely related to the extreme left-tail risk management of banks. Consequently, our findings imply that banks can and should consider investing and implementing more CSR activities/projects not only for enhancing the firm's intangible asset values but also as a strategic risk management tool to reduce their tail risk exposure. Regulators can also encourage banking institutions to pay more attention to improving their CSR intensity as a means of securing the health and sustainability of the whole banking and financial systems. Lastly, investors should also take into account non-financial CSR-related information in their investment strategies, especially in their pricing formula, regardless of whether the market is stable or turbulent.

Our study makes several significant contributions to the broad strands of literature. Firstly, we extend CSR research to financial industries (e.g., Devinney, 2009; Broadstock et al., 2020; Lu and Wang, 2020; Chen et al., 2021; Úbeda-García et al., 2021), and particularly the banking sector (e.g., Mallin et al., 2014; Wu and Shen, 2013; Jizi et al., 2014; Azmi et al., 2021), which have not explicitly considered the importance and implications of tail risk. Secondly, we add to prior studies on tail risk (e.g., Cohen et al., 2014; Srivastav et al., 2017; Hagendorff et al., 2018; Jalal and Rockinger, 2008; Wang et al., 2018; Bushman et al., 2018; Gupta and Chaudhry, 2019; Harris et al., 2019; Nguyen and Lambe, 2021) by empirically assessing the effect of social capital and trust within the financial sector. Our paper seeks to assess the relationship between CSR and downside equity tail risk within global banking institutions. Previous studies either examine this association within industrial equities (Diemont et al., 2016) or focus only on crash risk in non-financial companies (e.g., Kim et al., 2014; Albuquerque et al., 2020). Thirdly, we explore the research question on the nexus of CSR-tail risks under two exogenous adverse events, the global financial crisis of 2007–2009 and the ongoing COVID-19 pandemic. Our study, therefore, contributes to the literature on banking CSR during times of crises (e.g., Cornett et al., 2016; Bae et al., 2021; Demers et al., 2021; Qiu et al., 2021). Finally, our findings add to the growing evidence about global banking financial stability and performance (e.g., Ding et al., 2021; Elnahass et al., 2021; Li et al., 2021), which do not directly assess the implications of CSR and tail risk.

We also offer key implications to the market participants and policymakers. Our empirical analysis offers robust evidence regarding the beneficial effect of CSR performance, as proxied by ESG ratings, in lessening bank tail risk for the post-crisis period but not the crisis and pre-crisis periods. The evidence implies that trust among investors, market participants, and banks started developing through the banks' social capital investment after they suffered losses from the financial crisis between 2007 and 2009. In other words, CSR activities in banks became prevalent and essential to managers and investors after the turmoil. In addition, market participants seem to be more concerned about CSR and paid off their investments after the turmoil. Therefore, our finding encourages banks to engage more in 'ethical investments' to increase their market value and reduce their exposure to extreme stock devaluation during ordinary and turbulent times.

This paper is structured as follows. Section 2 presents the literature review, theoretical framework, and hypotheses. Sections 3 and 4 discuss the research design and main findings, respectively. Section 5 provides further investigations, and Section 6 offers robustness checks, including endogeneity treatments and propensity score matching analysis. Finally, Section 7 concludes the article.

2. Corporate social responsibility and bank tail risk

2.1. Research on CSR

Firms' CSR or ESG performance has been found to have a significant and positive relationship with financial performance and shareholder value (e.g., Orlitzky et al., 2003; Chaudhry et al., 2017; Lins et al., 2017; Li et al., 2019; Broadstock et al., 2020; Harjoto et al., 2020). However, some researchers (e.g., Aupperle et al., 1985; Devinney, 2009; Gao et al., 2021) have argued that firms' pro-social activities can involve an agency problem reflecting managerial opportunistic costs. As such, managers' CSR may represent their failure to efficiently allocate capital and hence reduces firm performance (e.g., Beji et al., 2018; Fu et al., 2019; Oh et al., 2019; Chen et al., 2020; Lu and Wang, 2020). While CSR study in industrial firms is burgeoning, the effect of CSR in financial institutions remains underexplored.

Banks' engagement in CSR appears to have become more important after the global financial catastrophe (2007–2009) and a series of scandals in financial sectors which not only eroded investors' confidence and trust in banks but also illustrate the complacency of these socially impactful firms and regulators (Jizi et al., 2014). An increasing number of studies have begun to attend to banking CSR. Existing research shows that banks with superior CSR or ESG performance appear to have stronger governance structure and are more capable of creating value for a wider range of stakeholders, including shareholders, debtholders, and depositors. For example, Azmi et al. (2021) find that bank value can be increased by a higher investment in CSR which can help banks gain easier access to cheaper external finance. The studies by Wu and Shen (2013) and Mallin et al. (2014) also suggest a beneficial effect of CSR on banks' financial performance. Moreover, Jizi et al. (2014) document evidence that CSR disclosure is positively associated with board independence and board size. They highlight that banks are under pressure since the eruption of the financial crisis and credit crunch (2007–2009), and that investors seem to have a long-term view on how banks acknowledge and respond to their social obligations, such as through CSR activities (Matten, 2006; Grove et al., 2011).

2.2. Research on tail risk

Tail risk is a newsworthy topic that has recently drawn more attention from the public and academics, particularly when firms' operations experience negative events. For example, events such as the financial crisis and the COVID-19 pandemic could cause a firm to suffer extremely large losses (Srivastav et al., 2017; Hagendorff et al., 2018) or extreme declines in their market value (stock price)

(Cohen et al., 2014). While the literature on tail risk within banks remains limited, prior studies have documented evidence that adopting conservative accounting policies, having transparent financial information disclosure systems (Cohen et al., 2014; Jin and Myers, 2006), and fostering sound corporate culture (Bushman et al., 2018; Dudley, 2014) can largely reduce firms' likelihood of being exposed to extreme market devaluation. These mechanisms can therefore protect banks from tail risks during financial distress (e.g., financial crisis). For instance, Jin and Myers (2006) find that firms' discretional choice of financial policies, such as the composition of on– and off-balance-sheet asset and liability portfolios which reduce the transparency and opacity of their financial reports, can affect the possibility of being exposed to extreme market devaluation, including tail risks, once the public learns about bad news. In addition, Cohen et al. (2014) establish a positive relationship between bank earnings management and tail risks. They document evidence showing that frequent and excessive earnings management tactics, such as the inclination to make discretionary provisions for loan loss, or discretionary realizations of security gains or losses, can increase the risk of extreme stock market returns if they constrain the investors' ability to receive sufficient authentic information about the firm (Cohen et al., 2014). Similarly, Hutton et al. (2009) find that abnormal accruals also affect bank tail risk. In addition, Hagendorff et al. (2018) examine the connections between bank tail risks, risk channels, government guarantees, and relative bank size [i.e., a bank's liabilities relative to national gross domestic product (GDP)]. Interestingly, they find that banking firms tend to exhibit a greater level of tail risk if they have a relatively larger size. Their results reveal that banks' tail risk is likely to transfer to creditors when their relative size increases, whilst wealth gain for shareholders is not recognised. Also, Acharya et al. (2017) find that larger banks are likely to exhibit higher systemic and undiversifiable risks.

Furthermore, Bushman et al. (2018) contend that toxic corporate culture in banks significantly contributed to the 2007–2009 financial crisis. Corporate culture represents a system of shared values and norms defining the important and appropriate attitudes and behaviours for organizational members; therefore, a sound internal culture leads to more effective decision-making. More importantly, Bushman et al. (2018) argue that CEO characteristics, typically their materialistic attitudes, can influence bank culture, which can in turn, affect and manifest in the daily work of other executives. Their study shows that banks managed by materialistic CEOs exhibit higher susceptibility to taking advantage of inside trading opportunities around government interventions during the financial crisis. These findings imply the importance of healthy corporate culture and effective governance mechanisms that can reduce a bank's tail risk exposure and other extreme market returns (losses).

2.3. CSR–Tail risk Nexus, literature Gap, and external shocks

As discussed above, although CSR and tail risk have been separately investigated for both industrial and financial firms in prior literature, there is a dearth of research on the potential effect of CSR in firms' exposure to tail risks (see Diemont et al., 2016); Kim et al., 2014; Albuquerque et al., 2020). Diemont et al. (2016) show a significant relationship between CSR and downside equity tail risk for equities of non-banking firms for the period of 2003 to 2011. Firms with higher CSR performance in a specific year are associated with higher or lower tail risk in the following four years. The authors conclude that the nature of the CSR–tail risk nexus should be dissimilar per area, CSR aspect, and period. Kim et al. (2014) find that the beneficial effect of CSR on stock price crash risk leads to high-CSR firms exhibiting lower future cash risk. As stressed by Diemont et al. (2016, p. 213), stock price crash risk and tail risk are two distinct financial constructs, with the former defined as 'the conditional skewness of return distribution, rather than the likelihood of extreme negative return'. More recently, Albuquerque et al. (2020) examine stock market crash risk in association with firms' environmental and social (ES) policies. Similar to Kim et al. (2014, they find that firms with higher ES ratings exhibit greater levels of stock returns, lower return volatility, and greater levels of operating profit margin under the COVID-19 pandemic and the subsequent lockdown period, which began in March 2020.

Nevertheless, there is a lack of empirical examination on the association between banks' tail risk and their CSR engagement either at the national or international level. There is also lack of research investigating such an association in the context of negative market events such as the 2007–2009 global financial crisis and the COVID-19 pandemic. Previous studies examine CSR for banks during the financial crisis but focus only on its relation to bank financial performance, but not bank tail risk (Cornett et al., 2016). Recent studies in banking during the pandemic place limited attention on or do not directly test for CSR and/or tail risk (e.g., Ding et al., 2021; Elnahass et al., 2021; Li et al., 2021); they generally examine the effect of the pandemic on bank performance and financial stability. For example, Bae et al. (2021) consider how CSR activities affect the stock market returns of U.S. nonfinancial firms in the wake of the COVID-19 pandemic, but they do not find any significant results during such crash period. Their results are interesting, as they imply a potential disconnect between a firm's CSR ratings and its actual actions. In addition, Demers et al. (2021) also find robust evidence that ESG rating has no significant effect on stock market returns during the COVID-19 crisis period, and they conclude that ESG ratings do not immunise firm stocks during the worldwide shock. Different from Bae et al. (2021) and Demers et al. (2021), Qiu et al. (2021) further question whether and how socially responsible firms from hospitality sectors can protect their value over the pandemic. They find that firms engaging more in CSR activities tend to experience higher stock returns as well as more attention from stakeholders during the early-stage of COVID-19 period.

2.4. Theory and hypotheses

In principle, there could be two opposing theoretical propositions regarding the link between CSR and bank tail risk. From the lens of agency theory and impression management theory, CSR activities can represent managerial opportunistic behaviours or attempts by firms to cover up their unethical behaviours (e.g., Hemingway and Maclagan, 2004; Diemont et al., 2016; Harjoto et al., 2020). If market participants suspect a bank's superior CSR performance is not genuine or if they receive information against the CSR performance of a bank, a downside tail risk will increase. There is also the possibility of deliberate unvirtuous behaviour that leads to a positive link between CSR and tail risk. That is, when CSR activities are implemented for reasons such as legal ones or do not mitigate actual tail risk, the investors' expectation may still trigger a reduced tail risk.

However, according to the moral capital theory of Godfrey (2005), intensive CSR conduct can be used by firms to earn more goodwill or intangible assets. During unexpected negative market events, such 'moral capital' might provide insurance-like protection to maintain and enhance shareholder wealth (referred to as relational wealth). Consequently, once banks attempt to achieve pro-CSR targets in line with shareholders preferred ethical values, the bank-shareholder relationship will be improved. That tends to facilitate the establishment of moral goodwill and to increase relational wealth. As such, this moral capital is generated from what shareholders perceive as good acts of banks, which in turn strengthens investors' trust in banks' strategic decisions. Therefore, any negative outcomes will be perceived as 'unintentional' and merely a temporary effect of external shocks. Overall, once banks' moral capital is developed from CSR activities and relational wealth is perceived, shareholders are likely to be more generous towards firms in adverse circumstances. Consequently, this implies that banks with superior CSR activities are less likely to experience extreme devaluations of their stock value, especially in the context of market disruptions, such as the 2007–2009 financial crisis and the COVID-19 pandemic (Godfrey, 2005; Gardberg and Fombrun, 2006; Godfrey et al., 2009; Diemont et al., 2016).

In line with prior CSR literature in industrial firms, we argue that the CSR activities of a bank can also create moral capital which protects the bank in light of the global financial crisis and the COVID-19 pandemic (Godfrey, 2005; Godfrey et al., 2009; Diemont et al., 2016). We expect that the bank's relationship with different stakeholders is extremely important, and the goodwill and social capital obtained from participating in CSR activities could help the bank establish a positive reputation (see Soppe et al., 2011). Such a reputation is the result of relational wealth, which is developed only if the ethical values of the stakeholders are satisfied by a bank's high CSR performance.

We acknowledge that this cannot ensure that the bank performs well in the stock market, but moral capital derived from CSR activities could either mitigate the possibility of negative acts by investors or control the significant reduction in relational wealth in case such negative acts occur. For these reasons, relational wealth could be protected if banks actively participate in CSR activities and achieve superior CSR performance (i.e., high ES scores rated by reputable organisations such as Refinitiv and MSCI). Following previous evidence reporting that CSR (or ESG rating) has beneficial effects on firm performance and risk-taking activities (e.g., Diemont et al., 2016; Kim et al., 2014; Albuquerque et al., 2020; Qiu et al., 2021), we hypothesise that the banks' ESG rating is significantly associated with lower tail risk:

H_1: ESG rating of banks is significantly associated with lower tail risk.

3. Research design

3.1. Sample construction and CSR performance measures

This study initially built a cross-country banking sample of 1,090 listed commercial banks traded in 116 international stock markets from 2002 to 2020. We use Bureau van Dijk's Bankscope database, and illiquid bank stocks are excluded because they cannot reflect correct information related to the anticipated firm performance and therefore result in unreliable bank measures for systematic and idiosyncratic tail risk. In addition, because the United States has a much greater number of banks than any other country, we use a criterion in which only the top 50 largest banks ranked by their total accounting assets are kept. This can prevent the over-representation of US banks (Beck et al., 2013; Hagendorff, 2018).

In particular, we merge information on cross-country banks' ESG ratings from the Thomson Reuters Refinitiv ESG database with financial, accounting, and market variables collected from DataStream using International Securities Identification Numbers (ISIN). Country-level factors were collected from the World Bank (accessed 15 April 2021). Missing data and the economy's financial freedom index are from the Heritage Foundation.[1] Our final sample consists of 244 banks listed in 52 stock markets (countries) globally, generating 2,481 bank-year observations. We define the COVID-19 period as 2020 (Elnahass et al., 2021) and the global financial crisis period as 2007–2009 (Srivastav et al., 2017). On this basis, we examine our research questions across two different estimation periods: pre-2010 (i.e., during the crisis, 2007–2009; and pre-crisis, 2002–2006) and post-2010 (i.e., post-crisis 2010–2020). The post-2010 period includes the COVID-19 pandemic shock year of 2020.

The Thomson Reuters Refinitiv ESG database has been used in several CSR-related studies, including Albuquerque et al. (2020), Bae et al. (2021), Lins et al. (2017), Cornett et al. (2016), and Demers et al. (2021). Refinitiv ESG statistics classify ESG performance into 10 different main categories: resource use, emissions, innovation, workplace, human rights, community, product responsibility, management, shareholders, and corporate social responsibility strategy. As in studies by Albuquerque et al. (2020) and Bae et al. (2021) and other previous research (e.g., Ferrell et al., 2016; Dyck et al., 2019), our main proxy is firms' ES rating (*ES_Refinitiv*) provided by the Refinitiv ESG database. This proxy is estimated by the average of only the E and S components, excluding the G score. The E component, representing the environment performance score, is evaluated based on three important categories including resource use, emissions, and innovation. The S component, representing the social commitment score, is measured according to four areas: workplace, human rights, community, and product responsibility. Each of the categories in the E and S components contain many ES themes,[2] and their score is built upon the relative performance as well as the materiality of ES factors within the banking industry. The G component is excluded from our main tests because corporate governance is generally regarded as not being a part of the corporate

[1] https://www.heritage.org/.

[2] For example, resource use, emission, and workforce.

CSR remit (Lins et al., 2017), and by doing this, we can avoid capturing a governance effect (Albuquerque et al., 2017).

We also employ several alternative measures of CSR activity (see Section 6.1). In sensitivity tests, we include three alternative proxies for CSR performance. First and second, we measure CSR by focusing on each component of the ES rating: firms' environmental (E) performance and social (S) commitment. As mentioned earlier, firms' environmental (E) performance (*Environment_Refinitiv*) is evaluated in three categories, and firms' social (S) commitment (*Social_Refinitiv*) is measured in four areas. The third alternative proxy is the combination of all three components of ESG rating including the last component, governance score, which is evaluated in three dimensions: management, shareholders, and CSR strategy. In other words, it is measured by the average of the environment, social, and governance scores. This inclusion of governance in our robustness check is consistent with the studies of Demers et al. (2021) and Lins et al. (2017) because the corporate governance category in ESG ratings in aggregate, or part of it, could be related to corporate trustworthiness.

Moreover, to confirm that our findings are not driven by the choice of indicators, we also follow Cornett et al. (2016) and employ relative measures of CSR performance. We argue that banks' CSR policies tend to follow certain 'norms' in banking sector trends. We thus use the relative ES rating, which is computed by $(ES_{it} - Min\_ES_{jt})/(Max\_ES_{jt} - Min\_ES_{jt})$ (*Relative ES_Refinitiv*) for each bank-year, to examine that argument. Similarly, we also measure relative E (*Relative Environment_Refinitiv* calculated by $(E_{it} - Min\_E_{jt})/(Max\_E_{jt} - Min\_E_{jt})$), relative S (*Relative Social_Refinitiv* computed by $(S_{it} - Min\_S_{jt})/(Max\_S_{jt} - Min\_S_{jt})$), and relative ESG rating (*Relative ESG_Refinitiv* estimated by $(ESG_{it} - Min\_ESG_{jt})/(Max\_ESG_{jt} - Min\_ESG_{jt})$), given that *i* stands for banks and *j* stands for the whole banking sector. As such, we create four relative indices for CSR performance, which allow us to examine a bank's ESG rating relative to other banks in the full sample or the banking sector.

3.2. Measures of bank tail risk

In this study, we follow prior literature in defining tail risk (e.g., Srivastav et al., 2017; Hagendorff et al., 2018; Bushman et al., 2018). We utilise two major alternative proxies for bank tail risk, idiosyncratic tail risk (Idiosyn_R) and systematic tail risk (Sys_R), which are bank-specific and market-based tail risks, respectively. In the asset pricing literature, a higher stock premium is required by investors to compensate for any undiversifiable risk that they endure (Fama and French, 2006). Hence, systematic tail risk is undoubtedly a relevant matter in practice, particularly for investors (Van Oordt and Zhou, 2016). Regarding idiosyncratic risk, despite its diversifiable property, Merton (1987) indicates that the risk also drives up the required equity premium and provides insightful implications on the risk management of banks, exclusively on left-tail risk management. Consequently, these two elements should be investigated in isolation as suggested by corporate finance literature.

The computation of the two tail risks (Idiosyn_R and Sys_R) consists of three stages. In the first stage, the total tail risk measured by the expected shortfall is computed. It captures the bank's worst 5 % stock loss in a given year (see Srivastav et al., 2017; Bushman et al., 2018; Aljughaiman and Salama, 2019), whose calculation can be mathematically written as follows:

$$ES^{\alpha}_{i,T} = -E(R_{i,t}|R_{i,t} \leq R^{\alpha}_{i,t} \quad (1)$$

where $ES^{\alpha}_{i,T}$ represents the total tail risk[3] or the expected shortfall of each bank *i* in each year *t*. This is estimated by the average of daily banking stock returns ($R_{i,t}$) that are at and beyond the αth (where $\alpha = 5$) return of the yearly distribution ($R^{\alpha}_{i,t}$).

Subsequently, the second stage involves an extraction of the residuals and the predicted values of the following augmented market model:

$$R_{i,t} = \beta_1 + \beta_2 \mathrm{R}_{\mathrm{m,t}} + \beta_3 \mathrm{R}_{\mathrm{b,t}} + \mu_{\mathrm{j,t}} \quad (2)$$

$$\Leftrightarrow R_{i,t} = \mathrm{Pred}_{i,t} + \mu_{\mathrm{j,t}}$$

where $R_{i,t}$ represents the daily stock return of bank *i* at year *t*, $R_{m,t}$ represents the daily market return and $R_{b,t}$ represents the average daily stock return of all banks in each country. $\mathrm{Pred}_{i,t}$ and $\mu_{j,t}$ are the predicted values and residuals of banks' daily stock returns, respectively. These two estimated variables are then employed in the third stage to calculate the idiosyncratic and systematic tail risks.

By definition, the idiosyncratic tail risk element is measured by the average of bank *i*'s stock loss at and beyond the fifth percentile of the yearly distribution. Meanwhile, the systematic tail risk element is estimated as the average of bank *i*'s stock loss at and beyond the fifth percentile of the yearly distribution. In this study, we utilise the residual component ($\mu_{j,t}$) to calculate the idiosyncratic expected shortfall and the predicted daily returns of banks ($Pred_{i,t} = \beta_1 + \beta_2 R_{m,t} + \beta_3 R_{b,t}$) for the computation of systematic expected shortfall. Accordingly, we obtain two components of bank tail risk as stated in equations 3 and 4 below:

$$Idiosyn\_R^{\alpha}_{i,T} = -E(R_{i,t}|R_{i,t} \leq \mu^{\alpha}_{i,t} \quad (3)$$

$$Sys\_R^{\alpha}_{i,T} = -E(R_{i,t}|R_{i,t} \leq Pred^{\alpha}_{i,t} \quad (4)$$

where $R_{i,t}$ represents the daily stock return of bank *i*, $\mu^{\alpha}_{i,t}$ represents the fifth percentile of the yearly distribution of the residuals, and $Pred^{\alpha}_{i,t}$ represents the fifth percentile of the yearly distribution of predicted returns.

Moreover, existing literature (e.g., Taylor, 2008; Bushman et al., 2018) has also employed alternative proxies for bank tail risk, such

[3] Results for total tail risk are unreported but will be provided upon request.

as value at risk and marginal expected shortfall. We therefore calculate and use these proxies in our unreported robustness check for the main results.[4] The first alternative measure, value at risk, is estimated by the bank's stock return at the lowest 5 % daily stock return in a given year (see equation 5) (Taylor, 2008). The measure is used by extant empirical studies such as those by Yamai and Yoshiba (2005), Srivastav et al. (2017), and Aljughaiman and Salama (2019). Nevertheless, value at risk has been claimed to be less coherent than the expected shortfall because of the ignorance of all stock returns beyond the left-tail 5 % (α) distribution (Taylor, 2008). Consequently, there is an incomplete picture of bank tail risk compared with our main measures computed from the expected shortfall.

$VaR^{\alpha}_{i,T} = -E(R_{i,t}|R_{i,t} \leq R^{\alpha}_{i,t})$ (5).

Similarly, we use marginal expected shortfall (MES) as an alternative measure for bank systematic tail risk. It is estimated similarly to the expected shortfall, yet it captures the average of a bank's stock returns over days that are at and beyond the lowest 5 % (α) of the market index in a given year (see equation 6) (Bushman et al., 2018).

$MES^{\alpha}_{i,T} = -E(R_{i,t}|R_{i,t} \leq R^{\alpha}_{i,t})$ (6).

3.3. Empirical models

The bank tail risk–CSR nexus in our study is mainly modelled by estimating the following ordinary least square (OLS) model with robust standard error:

$$TailR_{i,t} = a_i + \beta CSR_{i,t-1} + \Psi Covid_{i,t} + \varphi CSR_{u,t-1} * Covid_{i,t} + \lambda Bank_{i,t-1} + xCountry_{k,t} + \varepsilon \quad (7)$$

where $TailR_{i,t}$ represents the tail risk of bank *i* and year *t* measured by idiosyncratic (i.e., *Idiosyn_R*) and systematic measures (i.e., *Sys_R*). $CSR_{i,t-1}$ represents the CSR activities of bank *i* and year *t* − 1 measured by ES ratings (i.e., $ES\_Refinitiv_{t-1}$). $Covid_{i,t}$ represents the COVID-19 crisis dummy taking a value of one if the bank goes through the pandemic year (2020) and zero otherwise. The interaction between CSR activities and the COVID crisis ($CSR_{i,t-1} * Covid_{i,t}$) is included to examine whether the relationship between CSR and tail risk changed during the pandemic period. $Bank_{i,t-1}$ represents a vector of bank-level characteristics of each bank *i* in year *t* − 1, and $Country_{k,t}$ represents a vector of country-level characteristics of each country *k* in year *t*. We report the full definitions and measurements of all main variables in Table 1.

As highlighted by Diemont et al. (2016), there is possibly a causal relationship between CSR and tail risk, leading to potential simultaneity and endogeneity biases. We mitigate these issues by using one-year lagged values of CSR and all bank characteristics and also by using year dummies to capture variations in bank tail risk over years. We additionally use the two-step system generalised method of moments (GMM), two-stage least square (2SLS), three-stage least square (3SLS), and propensity score matching (PSM) as robustness checks (see Section 6) to address or at least minimise sample selection bias, simultaneity, and endogeneity. In addition, we also employ robust standard errors to control for heteroscedasticity.

Tail risk should be affected by several factors other than CSR performance; hence, we follow the study of Hagendorff et al. (2018) to construct a comprehensive vector of control variables including bank-level and country-level factors.

For the former, we include *Covid_crisis*, *Profitability*, *Book-to-Market*, *Stock volatility*, *Size*, *Loans*, *Credit risk*, *Leverage*, *Deposits*, and *Non-interest_Income*. *Covid_crisis*, defined previously, is a dummy variable. *Profitability* is a bank's accounting profitability, which is measured by return on total assets. *Book-to-Market* is estimated by the ratio of book value to market value of equity. *Stock volatility* is the daily market stock price volatility. *Size* is the bank stand-alone size calculated by the natural logarithm of firm total assets. *Loans* represents the asset profile of a bank, measured by the ratio of net loans and firm total assets. Other variables are defined as follows: *Credit risk* is by the ratio of loan loss provisions to firm total loans; *Leverage* is the ratio of bank liabilities to firm total assets; *Deposits* represents the funding profile of a bank, computed as the ratio of deposits to firm total assets; and *Non-interest_Income* is the involvement of a bank in business lines, calculated as the ratio of noninterest income to firm total operating income.

For the latter, we include some country factors that could influence bank tail risk. First, we include a country's *Development* measured by the natural logarithm of its gross domestic product per capita. We also include the real growth of a country's GDP (*Real-GDP-Growth*), determined by the logarithm of a country's real GDP growth. Furthermore, *Fiscal_Capacity*, *Private_Credit*, and *Financial_Freedom* are used to capture the fiscal capacity, private credit, and financial freedom of a country, respectively. *Fiscal_Capacity* is measured by the tax revenues minus public spending scaled by a country's GDP, *Private_Credit* is gauged by the ratio of private credit to a country's GDP, and *Financial_Freedom*[5] is the financial freedom index of a country.

3.4. Descriptive statistics

The descriptive statistics of our sample are reported in Table 2. The average (median) of the idiosyncratic tail risk (Idiosyn_R) is 0.06 (0.044) and systematic tail risk (Sys_R) is 0.057 (0.041). The min–max ranges of the former and the latter are (0.019–0.205) and (0.015–0.190), respectively. The mean of ES ratings (*ES_Refinitiv*) for banks in our sample is 0.392 or 39.2 %, and that of its components

[4] For brevity, we do not present it in the main text but will provide the results for these measures upon request.

[5] Following the study of Hagendorff et al. (2018), we employ an index of a country's financial freedom which is updated on a yearly basis. It is measured based on five difference areas: 'i) the extent of government regulation of financial services, ii) the degree of state intervention in banks and other financial firms through direct and indirect ownership, iii) the extent of financial and capital market development, iv) government influence on the allocation of credit, v) openness to foreign competition. For more details on the computation of the index' (Hagendorff et al., 2018, p. 2050). Data for this index are collected from the Heritage Foundation website (https://www.heritage.org).

Table 1
Variable Definitions.

Variable	Definition	Source and references
Panel A: Bank tail risk		
Main Measures		
Idiosyn_R	Idiosyncratic tail risk. It is a diversifiable element of bank tail risk or expected shortfall (ES), which is estimated as the average of bank i's stock loss at and beyond the 5 % percentile of the yearly distribution.	Srivastav et al., (2017); Hagendorff et al. (2018)
Sys_R	Systematic tail risk. It is an undiversifiable element of tail risk or expected shortfall (ES), which is estimated as the average of bank i's stock loss at and beyond the 5 % percentile of the yearly distribution.	Srivastav et al., (2017); Hagendorff et al. (2018)
Panel B: ESG Rating measures		
ES_Refinitiv	ES Rating, which is estimated as the average of the environment and social scores. It evaluates firms' environmental (E) performance in three categories: resource use, emissions, and innovation, and Social (S) commitments in four areas: workplace, human rights, community, and product responsibility.	Albuquerque et al. (2020); Bae et al. (2021)
Environment_Refinitiv	Firms' environmental (E) performance, evaluated in three categories: resource use, emissions, and innovation.	Albuquerque et al. (2020); Bae et al. (2021)
Social_Refinitiv	Firms' social (S) commitments, measured in in four areas: workplace, human rights, community, and product responsibility.	Albuquerque et al. (2020); Bae et al. (2021))
ESG_Refinitiv	ESG Rating, which is estimated as the average of the environment, social and governance scores. It evaluates firms' environmental (E) performance in three categories: resource use, emissions, and innovation, and Social (S) commitments in four areas: workplace, human rights, community, and product responsibility, and Governance (G) is evaluated in three dimensions: management, shareholders, and corporate social responsibility strategy.	Demers et al. (2021); Albuquerque et al. (2020)
Panel C: Bank-level control variables		
Covid_crisis	Covid-19 Crisis binary variable, which takes a value of 1 of the evaluated year is 2020 and 0 otherwise.	Elnahass et al. (2021)
Profitability	Firm accounting profitability, measured by return on total assets.	Hagendorff et al. (2018)
Book-to-Market	The ratio of book value and market value of equity.	Hagendorff et al. (2018)
Stock Volatility	Daily market stock price volatility.	Aljughaiman and Salama (2019)
Size	Firm size, estimated by the natural logarithm of firm total assets.	Hagendorff et al. (2018)
Loans	Asset profile of a bank, measured by the ratio of net loans and firm total assets.	Hagendorff et al. (2018)
Credit risk	The ratio of loan loss provisions (LLP) and firm total loans.	Hagendorff et al. (2018)
Leverage	The ratio of bank liabilities and firm total assets.	Hagendorff et al. (2018)
Deposits	Funding profile of a bank, computed as the ratio of deposits and firm total assets.	Hagendorff et al. (2018)
Non-interest_Income	The involvement of a bank in business lines, calculated as the ratio of non-interest income and firm total operating income.	Hagendorff et al. (2018)
Panel D: Country-level control variables		
Development	A country's development, measured by the natural logarithm of a country' gross domestic product per capita	Hagendorff et al. (2018)
Real-GDP-Growth	Real growth of a country's gross domestic product, measured by the logarithm of a country's real gross domestic product growth	Hagendorff et al. (2018)
Fiscal_Capacity	A country's Fiscal capacity, measured by the tax revenues minus public spending scaled by a country's gross domestic product.	Hagendorff et al. (2018)
Private_Credit	A country's private credit, measured by the ratio of private credit and a country's gross domestic product	Hagendorff et al. (2018)
Financial_Freedom	Financial freedom index of a country	Hagendorff et al. (2018)
Social trust	The country-level social trust, measured by the *mean %* response of the World Values Survey (WVS) question, i.e., "*Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?*", in the country where a recorded response is one (implying that the answer is "*the most people can be trusted*") and zero (implying other answers). Higher mean % suggests higher level of trust in the country.	Brockman et al. (2022)

This table presents definitions, measurements and sources/references of all main dependent and independent variables.

is 0.353 (environmental score) and 0.431 (social score). For the main proxy of CSR activity, we find that the minimum value of ES rating is 0.036, while its maximum value is 0.853.

In addition, the average banks have a return on assets of 0.9 %, book-to-market value of 1.001, and stock volatility of 0.021. The mean (median) of bank stand-alone size is 7.919 (7.863), that of the ratio of net loans to firm total assets is 0.610 (0.639), and that of credit risk (i.e., ratio of loan loss provisions to firm total loans) is 0.008 (0.005). Similarly, the average and median values of leverage ratio (deposits, noninterest income) are 0.909 (0.613, 1.409) and 0.918 (0.653, 1.014), respectively. Furthermore, our sample's average bank is headquartered in a country with a logarithmic transformation of GDP per capita of 3.875, with a logarithmic growth of real GDP of 0.51. We further report the correlation matrix results for all main independent variables in Table 3. The result reveals no serious multicollinearity issues among variables, which is supported by low variance inflation factor (VIF) values (unreported, provided upon request).

Table 2
Descriptive Statistics.

stats	N	mean	p50	sd	min	max	skewness	kurtosis	p25	p75
Idiosyn_R	2481	0.060	0.044	0.047	0.019	0.205	1.945	6.129	0.031	0.067
Sys_R	2481	0.057	0.041	0.045	0.015	0.190	1.756	5.407	0.028	0.068
ES_Refinitiv	2481	0.392	0.354	0.261	0.036	0.853	0.294	1.789	0.149	0.614
Environment_Refinitiv	2481	0.353	0.303	0.305	0.000	0.877	0.366	1.727	0.050	0.620
Social_Refinitiv	2481	0.431	0.420	0.243	0.047	0.861	0.157	1.965	0.234	0.620
ESG_Refinitiv	2481	0.420	0.395	0.220	0.089	0.804	0.216	1.834	0.227	0.604
Covid_crisis	2481	0.098	0	0.297	0	1	2.713	8.360	0	0
Profitability	2481	0.009	0.008	0.007	−0.001	0.025	0.675	2.835	0.004	0.013
Book-to-Market	2481	1.001	0.806	0.637	0.277	2.703	1.235	3.825	0.532	1.282
Stock Volatility	2481	0.021	0.018	0.009	0.010	0.044	0.990	3.138	0.014	0.026
Size	2481	7.919	7.863	0.641	6.758	9.105	0.135	2.281	7.501	8.388
Loans	2481	0.610	0.639	0.158	0.182	0.828	−1.060	3.867	0.540	0.723
Credit risk	2481	0.008	0.005	0.008	0.000	0.028	1.289	3.831	0.002	0.011
Leverage	2481	0.909	0.918	0.037	0.825	0.960	−0.705	2.638	0.886	0.938
Deposits	2481	0.613	0.653	0.198	0.113	0.864	−0.946	3.253	0.517	0.766
Non-interest_Income	2481	1.409	1.014	1.343	0.000	5.360	1.666	5.227	0.584	1.691
Development	2481	3.875	3.848	0.611	2.844	4.796	0.016	1.828	3.400	4.527
Real-GDP_Growth	2481	0.510	0.584	0.330	−0.111	0.961	−0.467	1.970	0.271	0.795
Fiscal_Capacity	2481	−6.519	−4.422	6.822	−20.168	0.000	−0.685	2.101	−11.997	0.000
Private_Credit	2481	73.791	53.095	56.175	0.000	182.611	0.673	2.210	33.470	117.499
Financial_Freedom	2481	0.488	0.500	0.188	0.100	0.800	−0.153	2.288	0.300	0.600

This table presents descriptive statistics of all main variables employed in our study. Table 1 reports full definitions and measurements of all variables.

4. Main Findings: ESG ratings and tail risk

4.1. Before the global financial crisis (2002–2009)

Table 4 reports the regression results on the relationship between CSR activities and bank tail risk for three subsamples: pre-2010 (Panel A: 2002–2009), during the crisis (Panel B: 2007–2009), and pre-crisis (Panel C: 2002–2006). While Panel B and Panel C show the results for models without interaction terms ($ES\_Refinitiv_{t-1}*Global\_crisis$) between ES ratings ($ES\_Refinitiv_{t-1}$) and the global financial crisis (*Global_crisis*), measured as a dummy variable taking a value of one if the observed year is 2007–2009 and zero otherwise, Panel A for the pre-2010 period consists of both during and pre-crisis subsamples and includes a dummy variable for the turmoil and its interactions. All variables including controls are winsorised at their 5th and 95th percentile values to reduce the effects of outliers. We also estimate our regressions using year fixed effects.[6]

The results, shown in Table 4, consistently indicate that there is no significant linkage between a bank's tail risk and social capital (ES ratings) for the whole pre-2009 period (columns 1 and 2), the during-crisis period (columns 3 and 4), and the pre-crisis period (columns 5 and 6). Our results extend previous findings on nonfinancial firms (e.g., Diemont et al., 2016). We explain that before the financial crisis incident ending in 2009, investors' awareness/requirement on a bank's investment in ES activities might not be sufficient for the creation of moral goodwill and relational wealth to be perceived. In other words, more engagement in CSR activities before 2010 did not pay off for banks either before or during crisis times.

4.2. After the global financial crisis (2010–2020)

Table 5 presents an analysis of the relationship between bank tail risk and CSR activities (measured by $ES\_Refinitiv_{t-1}$) for the post-crisis period (2010–2020). Panel A (models 1–2) shows regression results for idiosyncratic tail risk (*Idiosyn_R*), and Panel B (models 3–4) reveals those for systematic tail risk (*Sys_R*). In each panel, we present the results for both models without interactions (models 1 and 3) and with interactions (models 2 and 4) with the COVID-19 pandemic crisis (*Covid_crisis*). The reason to include these interactions is to allow CSR activities to have different effects during the recent external shock.

Our results from models 1 and 3 reveal that for the post-crisis period (2010–2020), banks with higher ES ratings are likely to exhibit lower idiosyncratic and systematic tail risk. In other words, banks with stronger conduct in ES activities are exposed to a lower chance of suffering from extreme stock devaluations, both bank-borne and market-borne tail risks. This outcome is consistent with our main study's hypothesis. Furthermore, the *Covid_crisis* dummy reveals a positive and significant coefficient across all model variations. This result is sensible since the historical stock market revealed drastic market plunges up to 30 %, such as the ATG (Greece) and CAC40 (France) from January 2020 to March 2020 (Statista, 2020). Likewise, banking institutions are likely to be exposed to similar market reactions during such tough times; hence, a higher tail risk seems inevitable. However, in models 2 and 4, we introduce *Covid_crisis*

[6] Following Stata (2009, p. 410) and Cohen et al. (2014), we do not include bank fixed effects because this could lead to biased coefficient estimates. However, we include them in our unreported tests and find that our estimates in the main Table 4 are not influenced. Tables will be provided upon reasonable request.

Table 3
Correlation Matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.ES_Refinitiv	1																		
2.Environment_Refinitiv	0.96*	1																	
3.Social_Refinitiv	0.94*	0.81*	1																
4.ESG_Refinitiv	0.97*	0.93*	0.91*	1															
5.Covid_crisis	0.04*	0.03	0.04*	0.03	1														
6.Profitability	−0.17*	−0.21*	−0.08*	−0.12*	−0.10*	1													
7.Book-to-Market	0.09*	0.12*	0.03	0.03	0.16*	−0.50*	1												
8.Stock Volatility	0.09*	0.08*	0.10*	0.07*	0.24*	−0.11*	0.23*	1											
9.Size	0.54*	0.57*	0.45*	0.55*	−0.04*	−0.30*	0.18*	−0.07*	1										
10.Loans	−0.08*	−0.10*	−0.05*	−0.08*	−0.02	0.05*	−0.01	−0.09*	−0.08*	1									
11.Credit risk	0.09*	0.06*	0.12*	0.07*	0.10*	0.01	0.15*	0.33*	−0.01	0.09*	1								
12.Leverage	0.24*	0.29*	0.16*	0.22*	−0.07*	−0.53*	0.19*	−0.04*	0.61*	0.04*	−0.15*	1							
13.Deposits	−0.24*	−0.25*	−0.20*	−0.23*	0.03	0.12*	−0.01	−0.17*	−0.14*	0.45*	0.01	0.00	1						
14.Non-interest_Income	0.23*	0.25*	0.18*	0.22*	−0.01	−0.28*	0.18*	0.07*	0.26*	−0.15*	0.12*	0.23*	−0.18*	1					
15.Development	−0.01	−0.04*	0.02	−0.03	0.20*	0.15*	−0.02	0.01	−0.10*	−0.02	0.10*	−0.13*	0.11*	−0.06*	1				
16.Real-GDP_Growth	−0.00	0.01	−0.02	0.02	−0.02	−0.07*	0.04*	−0.03*	0.11*	0.11*	−0.06*	0.10*	0.00	0.05*	−0.39*	1			
17.Fiscal_Capacity	0.08*	0.09*	0.06*	0.08*	−0.17*	−0.08*	0.01	−0.00	0.01	−0.06*	−0.05*	0.04*	−0.12*	0.01	−0.31*	0.32*	1		
18.Private_Credit	−0.01	−0.02	0.00	−0.02	−0.04*	0.12*	−0.05*	−0.04*	−0.07*	−0.00	0.07*	−0.08*	0.07*	−0.08*	0.58*	−0.19*	0.02	1	
19.Financial_Freedom	0.07*	0.05*	0.10*	0.06*	0.03	0.15*	−0.10*	−0.06*	0.02	−0.01	0.05*	−0.08*	0.01	−0.01	0.61*	−0.25*	−0.28*	0.35*	1

This table presents the Pearson correlation matrix among all pairs of independent variables employed in our study. Table 1 reports full definitions and measurements of all variables.

Table 4
CSR Performance and Bank Tail Risk: The Pre-2010 (2002–2009) Period.

VARIABLES	Panel A: Full Period (2002–2009) *Idiosyncratic Tail Risk*	*Systematic Tail Risk*	Panel B: Crisis Period (2007–2009) *Idiosyncratic Tail Risk*	*Systematic Tail Risk*	Panel C: Pre-Crisis Period (2002–2006) *Idiosyncratic Tail Risk*	*Systematic Tail Risk*
ES_Refinitiv $_{t-1}$	0.004	0.008	0.008	0.000	−0.031	−0.019
	(0.850)	(0.664)	(0.687)	(0.986)	(0.155)	(0.304)
Global_crisis	0.051***	0.044***				
	(0.002)	(0.003)				
ES_Refinitiv $_{t-1}$ * Global_crisis	−0.013	−0.008				
	(0.546)	(0.663)				
Profitability $_{t-1}$	0.768	0.577	0.547	0.154	−0.052	−0.281
	(0.180)	(0.284)	(0.461)	(0.794)	(0.966)	(0.819)
Book-to-Market $_{t-1}$	0.023***	0.021***	0.025**	0.019**	0.025**	0.017
	(0.003)	(0.002)	(0.019)	(0.033)	(0.047)	(0.190)
Stock Volatility $_{t-1}$	−1.781***	−1.493***	−1.468**	−1.208**	−3.199***	−2.130**
	(0.001)	(0.001)	(0.015)	(0.016)	(0.003)	(0.029)
Size $_{t-1}$	0.002	0.001	−0.010	−0.002	0.020	0.016
	(0.775)	(0.870)	(0.316)	(0.799)	(0.118)	(0.198)
Loans $_{t-1}$	−0.013	0.020	−0.038	0.001	0.070**	0.102***
	(0.469)	(0.206)	(0.170)	(0.967)	(0.038)	(0.001)
Credit risk $_{t-1}$	−0.341	−1.014*	0.410	−0.239	−3.479**	−5.641***
	(0.581)	(0.085)	(0.508)	(0.711)	(0.011)	(0.000)
Leverage $_{t-1}$	0.119	0.012	0.251*	0.041	0.143	0.091
	(0.206)	(0.885)	(0.072)	(0.695)	(0.369)	(0.560)
Deposits $_{t-1}$	0.016	−0.004	0.048**	0.004	0.000	0.001
	(0.174)	(0.721)	(0.033)	(0.862)	(0.985)	(0.957)
Non-interest_Income $_{t-1}$	0.004**	0.004**	0.008**	0.007**	0.002	0.002
	(0.033)	(0.043)	(0.016)	(0.021)	(0.621)	(0.508)
Development	−0.012**	−0.009*	−0.008	0.005	−0.017**	−0.022***
	(0.028)	(0.072)	(0.398)	(0.562)	(0.023)	(0.004)
Real-GDP_Growth	−0.018	−0.006	−0.005	0.008	−0.073***	−0.057***
	(0.111)	(0.537)	(0.717)	(0.510)	(0.000)	(0.002)
Fiscal_Capacity	−0.000	−0.001	−0.001*	−0.001*	0.002*	0.001
	(0.500)	(0.245)	(0.078)	(0.065)	(0.098)	(0.236)
Private_Credit	0.000	0.000	0.000	0.000	−0.000	−0.000
	(0.564)	(0.956)	(0.211)	(0.893)	(0.181)	(0.222)
Financial_Freedom	−0.003	0.027*	−0.064**	−0.024	0.041	0.063**
	(0.834)	(0.056)	(0.037)	(0.308)	(0.113)	(0.011)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.015	0.058	−0.028	0.056	−0.115	−0.064
	(0.806)	(0.311)	(0.788)	(0.506)	(0.248)	(0.543)
Observations	345	345	156	156	138	138
R-squared	0.174	0.252	0.179	0.153	0.265	0.320
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000

This table presents OLS regression results for the effects of CSR performance on bank tail risk pre-2010 (2002–2009) period. The dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Idiosyn_R) and Systematic Tail Risk (Sys_R). The main independent variable is the CSR performance measured by ES ratings ($ES\_Refinitiv_{t-1}$). The inclusion of interaction terms between ES Rating and Global Crisis dummy ($ES\_Refinitiv_{t-1}$ * Global_crisis) aims to test the differential effects between crisis and Pre-crisis periods. A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

interaction terms ($ES\_Refinitiv_{t-1}*Covid\_crisis$) which allow ES ratings to have different impacts on the COVID and non-COVID periods. For this model specification, we find a consistently and significantly negative association between *ES_Refinitiv* and tail risk measures, suggesting that higher ES ratings could reduce a bank's possibility of suffering large negative losses in the pre-COVID years. Nevertheless, the interaction terms between the *Covid_crisis* dummy, and ES ratings are statistically insignificant, implying that such negative influences of CSR activities in previous years on bank tail risk do not differ across the non-COVID and COVID periods. In unreported checks, we also test the relation between tail risk and CSR for a cross-sectional sample in 2020 (COVID time) and find significant results.[7]

Taken together, our evidence covering the post-crisis period suggests that investment in CSR activities can create social and moral capital which can ultimately enhance the trust between banks and their investors since an increased relational wealth can be perceived. Intriguingly, the same positive influence of CSR on reducing tail risk pays off in the context of the COVID-19 pandemic. In other words,

[7] Table will be provided upon request.

Table 5
CSR Performance and Bank Tail Risk: Post-2010 (post-crisis 2010–2020) Period.

VARIABLES	Panel A: Idiosyncratic Tail Risk (Idiosyn_R) (1)	(2)	Panel B: Systematic Tail Risk (Sys_R) (3)	(4)
ES_Refinitiv $_{t-1}$	−0.010*	−0.009*	−0.010*	−0.010**
	(0.069)	(0.086)	(0.059)	(0.045)
Covid_crisis	0.024	0.025	0.029	0.027
	(0.000)	(0.005)	(0.000)	(0.001)
ES_Refinitiv $_{t-1}$* Covid_crisis		−0.003		0.005
		(0.816)		(0.674)
Profitability $_{t-1}$	−0.729	−0.729	−0.508**	−0.509**
	(0.002)	(0.002)	(0.019)	(0.019)
Book-to-Market $_{t-1}$	−0.001	−0.001	−0.002	−0.002
	(0.605)	(0.604)	(0.259)	(0.260)
Stock Volatility $_{t-1}$	0.240	0.239	0.207	0.209
	(0.166)	(0.167)	(0.192)	(0.189)
Size $_{t-1}$	0.004*	0.004*	0.005*	0.005*
	(0.082)	(0.082)	(0.057)	(0.057)
Loans $_{t-1}$	−0.010	−0.010	0.002	0.002
	(0.223)	(0.224)	(0.811)	(0.812)
Credit risk $_{t-1}$	0.291	0.292	0.160	0.159
	(0.104)	(0.103)	(0.348)	(0.350)
Leverage $_{t-1}$	−0.103**	−0.103**	−0.070	−0.070
	(0.034)	(0.034)	(0.111)	(0.112)
Deposits $_{t-1}$	0.011	0.011	−0.003	−0.003
	(0.137)	(0.135)	(0.727)	(0.711)
Non-interest_Income $_{t-1}$	−0.000	−0.000	−0.000	−0.000
	(0.822)	(0.824)	(0.764)	(0.761)
Development	−0.000	−0.000	0.001	0.001
	(0.881)	(0.880)	(0.709)	(0.708)
Real-GDP_Growth	0.003	0.003	0.003	0.003
	(0.357)	(0.357)	(0.404)	(0.403)
Fiscal_Capacity	−0.000	−0.000	−0.000	−0.000
	(0.377)	(0.373)	(0.222)	(0.225)
Private_Credit	0.000	0.000	0.000**	0.000**
	(0.002)	(0.002)	(0.021)	(0.022)
Financial_Freedom	−0.003	−0.003	−0.006	−0.006
	(0.727)	(0.730)	(0.400)	(0.397)
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.108	0.108	0.071**	0.071**
	(0.006)	(0.006)	(0.047)	(0.047)
No. of obs.	1,892	1,892	1,892	1,892
R-squared	0.160	0.160	0.129	0.129

This table presents OLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period. The dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Panel A: Idiosyn_R) and Systematic Tail Risk (Panel B: Sys_R). The main independent variable is the CSR performance measured by ES ratings (ES_Refinitiv$_{t-1}$). The inclusion of interaction terms between ES Rating and Covid dummy (ES_Refinitiv$_{t-1}$ * Covid_crisis) aims to test the differential effects between COVID and Pre-COVID periods. A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

even during the pandemic, in which investors' financial wealth is likely to plunge, investors still value the non-financial CSR behaviours of banks.

Moreover, the significant reduction in bank tail risk caused by higher ES rating post crisis implies a substantially increasing awareness, as well as stock market valuation, by market participants regarding the social responsibilities of banking institutions towards their economies and societies after experiencing huge losses and several scandals during a turbulent shock. The economic impacts in Table 5 show that on average, a 10 % increase in ES rating could help reduce tail risk by 0.1 %. For the control variables, we find that *Profitability*$_{t-1}$ has a significant and negative relationship with a bank's idiosyncratic and systematic tail risks. This finding suggests that banks with more profitability levels (return on assets) enjoy lower extreme negative losses, and it is probable that high profitability builds the trust of investors in a bank's overall capability in upholding its operations during unexpected market events. This possibility is consistent with the findings of Hagendorff et al. (2018) and Cornett et al. (2016), who show a positive link between CSR ratings and bank performance in post-crisis periods. In addition, the results for *Size*$_{t-1}$ reveal that larger banks tend to have higher tail risk (both measures) than their smaller peers. Finally, we find significantly negative effects of a firm's financial leverage (*Leverage*$_{t-1}$) on idiosyncratic tail risk, but it is insignificant on systematic tail risk regressions. This outcome is also expected since the debt adoption of banks is directly related to their risk management and hence should affect the bank-borne element of tail risk.[8]

5. Additional investigations

Results in Section 4 reveal a significant link between ES ratings and bank tail risk after the global financial crisis of 2007–2009. Therefore, in this section, we present some additional tests and robustness checks based on this post-crisis sample. For brevity, unreported tables for the pre-crisis and during-crisis periods will be provided upon request.

5.1. The moderating effect of social trust

We first examine the moderating effect of the country-level social trust (Social Trust) on the relationship between ES ratings and two alternative tail risk measures. This analysis aims to provide extended evidence on the role of faith and social commitment in mitigating banking tail risk. Following Brockman et al. (2022), we measure the country-level social trust using the country-level average percentage of affirmative responses to the question of the World Values Survey[9]—"Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?"—in the country where a recorded response is one (implying that the answer is "the most people can be trusted") and zero (implying other answers). A higher mean percentage for the Social Trust variable suggests a higher level of trust in the country. Given our sample period, we use the survey results for four different waves: 1999–2004, 2005–2009, 2010–2014, and 2017–2022.

We report the results in Table 6 (Panels A and B). We generally find the vital role of country-level social trust in the relationship between ES ratings and two measures of tail risks. Indeed, the interaction terms (i.e., $ES\_Refinitiv_{t-1}$*Social Trust) are consistently negative and significant, suggesting that in countries with higher levels of social trust, ES ratings are more likely to reveal their benefits with regard to the bank tail risks. After we capture the Covid-19 effects, we find no different results for Idiosyncratic Tail Risk before and after the pandemic. However, our results provide significant evidence for Systematic Tail Risk, indicating that the negative moderating impact of social trust is reduced during such a crisis. This finding implies that the Covid-19 pandemic appears to influence the role of social trust.

5.2. Robustness tests for CSR measure

5.2.1. Environment and social score components of ESG rating

We additionally consider the individual ES dimension hypothesis by examining whether different components of ES ratings (i.e., environmental and social) have dissimilar impacts on bank tail risks after 2010 (post-crisis period). We conduct these tests because each sector is unique, and relative to nonfinancial firms, banking institutions may face different pressures from their stakeholders. For example, stakeholders within this sector may be more interested in the lending activities of banks rather than their contributions to the environment or charity (see Azmi et al., 2021). In Panel A and Panel B of Table 7, we regress bank tail risk measures on the rating scores of environments ($Environment\_Refinitiv_{t-1}$) and society ($Social\_Refinitiv_{t-1}$) categories. In models 1–4, the dependent variable is idiosyncratic tail risk, and in models 7–10, the dependent variable is systematic tail risk.

We find that the coefficient estimates on social rating are insignificant, while those on environment rating in models 1 and 2 and models 7 and 8 are significant and negative. This outcome implies that our main findings are driven by environmental scores rather than social ones. In other words, banks with higher environmental ratings tend to exhibit lower bank tail risk, both idiosyncratic and systematic. Note that in models 2, 4, 8, and 10, we interact each ES component with the COVID-19 crisis dummy ($Rate\_Refinitiv_{t-1}*Covid\_crisis$) to investigate whether the association between CSR and tail risk changes under this pandemic shock. Our results still reveal that for both components of ES ratings, the link is insignificant, which implies that the COVID-19 crisis has not changed investors' positive evaluation of banking stocks with high ES performance.

5.2.2. Incorporate all three components of ESG rating

In our main analyses, we follow previous CSR-related literature (e.g., Servaes and Tamayo, 2013; Giuli and Kostovetsky, 2014) to exclude the corporate governance component (G), as it should not be considered as part of CSR activities. However, to ensure that our results are not affected by the changing nature of the ESG Infinitive database, in this section, we incorporate all three components of ESG ratings and rerun some empirical tests. We follow the studies of Albuquerque et al. (2020), Cornett et al. (2016), and Azmi et al. (2021) to incorporate the governance rating into our main ES ratings measure. As mentioned earlier, ESG rating is estimated as the

[8] In unreported tests, we conduct similar investigations on the CSR–tail risk nexus for the whole sample (before, during, and after crisis) from 2002 to 2020 including the COVID-19 dummy. We find a significant and negative association between ES ratings and both bank tail risk measures for the whole sample, implying that on average, a bank's tail risk is likely to diminish as a bank invests more in social capital to increase the trust of investors (higher ES ratings). Furthermore, the insignificant interaction terms between ES ratings and the dummies capturing the current market disruptions (i.e., COVID times) indicate that, in general, the effects of ES ratings on tail risk remain relatively stable across periods. As expected, we also find that the health crisis has contributed to an increase in the tail risks of global banks. Our findings further suggest that during the difficult period, specifically the COVID-19 pandemic, investors are likely to react extremely in their devaluations of banking stocks perhaps because of emotional insecurity, lack of trust, and heightened uncertainty.

[9] https://www.worldvaluessurvey.org/.

Table 6
The Moderating Effect of the Country-level Social Trust: Post-2010 (post-crisis 2010–2020) Period.

VARIABLES	Panel A: Idiosyncratic Tail Risk (Idiosyn_R) (1)	(2)	Panel B: Systematic Tail Risk (Sys_R) (3)	(4)
ES_Refinitiv $_{t-1}$ * Social Trust	−0.072	−0.078	−0.081	−0.093
	(0.005)	(0.004)	(0.001)	(0.000)
ES_Refinitiv $_{t-1}$ * Social Trust * Covid_crisis		0.027		0.054**
		(0.266)		(0.036)
ES_Refinitiv $_{t-1}$	0.015	0.016	0.018*	0.020*
	(0.189)	(0.168)	(0.095)	(0.066)
SocialTrust_w	0.017	0.018	0.029**	0.031**
	(0.217)	(0.199)	(0.031)	(0.024)
Covid_crisis	0.022	0.018**	0.027	0.019**
	(0.002)	(0.032)	(0.000)	(0.013)
Profitability $_{t-1}$	−0.449	−0.447	−0.300	−0.296
	(0.106)	(0.109)	(0.238)	(0.248)
Book-to-Market $_{t-1}$	−0.001	−0.001	−0.003	−0.003
	(0.640)	(0.635)	(0.218)	(0.213)
Stock Volatility $_{t-1}$	0.206	0.206	0.171	0.173
	(0.282)	(0.280)	(0.337)	(0.332)
Size $_{t-1}$	0.002	0.002	0.002	0.002
	(0.440)	(0.458)	(0.549)	(0.590)
Loans $_{t-1}$	−0.016*	−0.016*	−0.002	−0.002
	(0.094)	(0.092)	(0.837)	(0.823)
Credit risk $_{t-1}$	0.148	0.143	0.002	−0.007
	(0.470)	(0.486)	(0.991)	(0.970)
Leverage $_{t-1}$	−0.008	−0.007	−0.005	−0.004
	(0.890)	(0.897)	(0.928)	(0.943)
Deposits $_{t-1}$	0.015*	0.015*	−0.005	−0.005
	(0.096)	(0.096)	(0.548)	(0.543)
Non-interest_Income $_{t-1}$	0.000	0.000	0.000	0.000
	(0.885)	(0.898)	(0.904)	(0.931)
Development	−0.003	−0.003	−0.001	−0.001
	(0.307)	(0.290)	(0.772)	(0.706)
Real-GDP_Growth	0.004	0.004	0.004	0.004
	(0.344)	(0.340)	(0.363)	(0.353)
Fiscal_Capacity	−0.000	−0.000	−0.000	−0.000
	(0.457)	(0.461)	(0.203)	(0.207)
Private_Credit	0.000**	0.000**	0.000	0.000
	(0.019)	(0.018)	(0.112)	(0.104)
Financial_Freedom	−0.002	−0.002	−0.006	−0.006
	(0.798)	(0.818)	(0.447)	(0.478)
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.046	0.046	0.037	0.039
	(0.331)	(0.323)	(0.384)	(0.366)
No. of obs.	1,480	1,480	1,480	1,480
R-squared	0.040	0.041	0.054	0.056

This table presents OLS regression results for the moderating effects of social trust on the relationship between CSR performance, bank tail risk, and the Covid-19 pandemic for the post-2010 (post-crisis 2010–2020) period. The dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Panel A: Idiosyn_R) and Systematic Tail Risk (Panel B: Sys_R). The main independent variable is the CSR performance measured by ES ratings ($ES\_Refinitiv_{t-1}$), and its interaction with social trust ($ES\_Refinitiv_{t-1}$ * Social Trust). A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

average values of environment, social, and governance scores, and the last component (governance) is evaluated in three dimensions, including management, shareholders, and corporate social responsibility strategy.

We report our results for this measure in Table 7, Panel A (models 5 and 6) and Panel B (models 11 and 12). The coefficients of ESG are negative and significant, which shows that our main findings remain when we add the G component to the ES rating. Accordingly, even if we change the ESG rating by excluding G, CSR activities still impose a negative impact on bank tail risk measures in the post-crisis period, and the impact remains relatively similar during turbulent times such as the COVID-19 pandemic (based on the insignificant interaction term with the *Covid_crisis* dummy). Overall, the findings are consistent with our main tests.

5.2.3. *Relative measures of CSR performance*

As highlighted above, we would like to check that our findings are not driven by the choices of indicators. Hence, we use alternative proxies for CSR performance which represent relative measures and are in line with prior literature (see Cornett et al., 2016). The

Table 7
Alternative Measures of CSR Performance: Post-2010 (post-crisis 2010–2020) Period.

	Panel A: Idiosyncratic Tail Risk (Idiosyn_R)						Panel B: Systematic Tail Risk (Sys_R)					
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Environment_Refinitiv $_{t-1}$	−0.010**	−0.009**					−0.010**	−0.011**				
	(0.038)	(0.042)					(0.025)	(0.014)				
Social_Refinitiv $_{t-1}$			−0.007	−0.006					−0.007	−0.006		
			(0.186)	(0.266)					(0.203)	(0.235)		
ESG_Refinitiv $_{t-1}$					−0.014**	−0.013*					−0.015**	−0.016**
					(0.045)	(0.052)					(0.021)	(0.015)
Covid_crisis	0.024***	0.025***	0.023***	0.026***	0.024***	0.026**	0.029***	0.026***	0.028***	0.029***	0.030***	0.027***
	(0.000)	(0.003)	(0.000)	(0.007)	(0.000)	(0.012)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.004)
Rate_Refinitiv $_{t-1}$* Covid_crisis		−0.001		−0.007		−0.003		0.008		−0.002		0.007
		(0.909)		(0.644)		(0.867)		(0.450)		(0.898)		(0.664)
Profitability $_{t-1}$	−0.741***	−0.741***	−0.714***	−0.715***	−0.719***	−0.719***	−0.522**	−0.524**	−0.493**	−0.493**	−0.500**	−0.500**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.016)	(0.016)	(0.022)	(0.022)	(0.020)	(0.020)
Book-to-Market $_{t-1}$	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.002	−0.002	−0.002	−0.002	−0.003	−0.003
	(0.618)	(0.618)	(0.653)	(0.650)	(0.520)	(0.520)	(0.258)	(0.260)	(0.300)	(0.300)	(0.194)	(0.196)
Stock Volatility $_{t-1}$	0.241	0.240	0.225	0.225	0.246	0.246	0.211	0.213	0.190	0.190	0.220	0.221
	(0.163)	(0.164)	(0.193)	(0.194)	(0.155)	(0.156)	(0.184)	(0.178)	(0.233)	(0.233)	(0.168)	(0.165)
Size $_{t-1}$	0.005*	0.005*	0.004	0.004	0.005*	0.005*	0.005**	0.005**	0.004	0.004	0.006**	0.006**
	(0.061)	(0.061)	(0.145)	(0.147)	(0.059)	(0.059)	(0.036)	(0.036)	(0.123)	(0.124)	(0.029)	(0.028)
Loans $_{t-1}$	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010	0.002	0.002	0.002	0.002	0.002	0.002
	(0.216)	(0.217)	(0.211)	(0.211)	(0.235)	(0.235)	(0.821)	(0.826)	(0.841)	(0.841)	(0.776)	(0.774)
Credit risk $_{t-1}$	0.284	0.284	0.297*	0.298*	0.284	0.284	0.152	0.151	0.165	0.165	0.151	0.150
	(0.112)	(0.112)	(0.098)	(0.097)	(0.114)	(0.113)	(0.370)	(0.375)	(0.333)	(0.332)	(0.374)	(0.378)
Leverage $_{t-1}$	−0.102**	−0.102**	−0.103**	−0.103**	−0.107**	−0.107**	−0.069	−0.069	−0.070	−0.070	−0.075*	−0.075*
	(0.036)	(0.036)	(0.035)	(0.034)	(0.029)	(0.029)	(0.116)	(0.118)	(0.115)	(0.115)	(0.090)	(0.092)
Deposits $_{t-1}$	0.011	0.011	0.012	0.012	0.011	0.011	−0.003	−0.003	−0.002	−0.002	−0.003	−0.003
	(0.154)	(0.153)	(0.105)	(0.101)	(0.143)	(0.142)	(0.677)	(0.650)	(0.828)	(0.833)	(0.686)	(0.669)
Non-interest_Income $_{t-1}$	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.863)	(0.864)	(0.743)	(0.749)	(0.865)	(0.866)	(0.817)	(0.811)	(0.675)	(0.677)	(0.832)	(0.830)
Development	−0.001	−0.001	−0.000	−0.000	−0.001	−0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.841)	(0.842)	(0.927)	(0.918)	(0.849)	(0.848)	(0.755)	(0.761)	(0.664)	(0.667)	(0.750)	(0.748)
Real-GDP_Growth	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003
	(0.347)	(0.347)	(0.356)	(0.356)	(0.328)	(0.329)	(0.394)	(0.390)	(0.400)	(0.400)	(0.372)	(0.368)
Fiscal_Capacity	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.382)	(0.381)	(0.334)	(0.324)	(0.381)	(0.377)	(0.230)	(0.233)	(0.185)	(0.182)	(0.236)	(0.240)
Private_Credit	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.019)	(0.019)	(0.023)	(0.023)	(0.020)	(0.021)
Financial_Freedom	−0.002	−0.002	−0.003	−0.003	−0.003	−0.003	−0.006	−0.006	−0.006	−0.006	−0.006	−0.006
	(0.749)	(0.750)	(0.680)	(0.688)	(0.714)	(0.715)	(0.423)	(0.418)	(0.361)	(0.363)	(0.398)	(0.397)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.105***	0.105***	0.114***	0.114***	0.109***	0.109***	0.067*	0.067*	0.077**	0.077**	0.070**	0.071**
	(0.008)	(0.008)	(0.004)	(0.004)	(0.006)	(0.006)	(0.064)	(0.063)	(0.030)	(0.030)	(0.048)	(0.048)
No. of obs.	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892
R-squared	0.159	0.159	0.159	0.159	0.159	0.159	0.129	0.129	0.129	0.129	0.129	0.129

This table presents OLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period, employing alternative measures of CSR performance. The dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Panel A: Idiosyn_R) and Systematic Tail Risk (Panel B: Sys_R). The main independent variable is the CSR performance measured by three different proxies: Environment score (Environment_Refinitiv$_{t-1}$), social score (Social_Refinitiv$_{t-1}$), and full ESG score (ESG_Refinitiv$_{t-1}$). The inclusion of interaction terms between CSR performance and Covid dummy (Rate_Refinitiv$_{t-1}$ * Covid_crisis) aims to test the differential effects between COVID and Pre-COVID periods. A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

rationale for employing these relative proxies is that the CSR strategies of banking firms are likely to follow certain ‘norms’ in banking sector trends. The measurements of relative ES rating (*Relative ES_Refinitiv*), relative E rating (*Relative Environment_Refinitiv*), relative S rating (*Relative Social_Refinitiv*), and relative ESG rating (*Relative ESG_Refinitiv*) are as follows (equations 8–11, respectively):

$$Relative\ ES\_Refinitiv = \left(ES_{it} - Min\_ES_{jt}\right)/\left(Max\_ES_{jt} - Min\_ES_{jt}\right) \tag{8}$$

$$Relative\ Environment\_Refinitiv = \left(E_{it} - Min\_E_{jt}\right)/\left(Max\_E_{jt} - Min\_E_{jt}\right)) \tag{9}$$

$$Relative\ Social\_Refinitiv = \left(S_{it} - Min\_S_{jt}\right)/\left(Max\_S_{jt} - Min\_S_{jt}\right)) \tag{10}$$

$$Relative\ ESG\_Refinitiv = \left(ESG_{it} - Min\_ESG_{jt}\right)/\left(Max\_ESG_{jt} - Min\_ESG_{jt}\right)) \tag{11}$$

Table 8
Relative Measures of CSR Performance: Post-2010 (post-crisis 2010–2020) Period.

PART I: WITHOUT INTERACTIONS								
	Panel A: Idiosyncratic Tail Risk (Idiosyn_R)				Panel B: Systematic Tail Risk (Sys_R)			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative ES_Refinitiv $_{t-1}$	−0.008*				−0.008*			
	(0.069)				(0.059)			
Relative Environment_Refinitiv $_{t-1}$		−0.008**				−0.009**		
		(0.038)				(0.025)		
Relative Social_Refinitiv $_{t-1}$			−0.006				−0.005	
			(0.186)				(0.203)	
Relative ESG_Refinitiv $_{t-1}$				−0.010**				−0.011**
				(0.045)				(0.021)
Covid_crisis	0.024***	0.024***	0.023***	0.024***	0.029***	0.029***	0.028***	0.030***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.108***	0.105***	0.114***	0.108***	0.070**	0.067*	0.077**	0.069*
	(0.006)	(0.008)	(0.004)	(0.006)	(0.048)	(0.064)	(0.030)	(0.053)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892
R-squared	0.159	0.159	0.159	0.159	0.129	0.129	0.129	0.129
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PART II: WITH INTERACTIONS								
	Panel A: Idiosyncratic Tail Risk (Idiosyn_R)				Panel B: Systematic Tail Risk (Sys_R)			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relative ES_Refinitiv $_{t-1}$	−0.008*				−0.009**			
	(0.086)				(0.045)			
Relative Environment_Refinitiv $_{t-1}$		−0.008**				−0.010**		
		(0.042)				(0.014)		
Relative Social_Refinitiv $_{t-1}$			−0.005				−0.005	
			(0.266)				(0.235)	
Relative ESG_Refinitiv $_{t-1}$				−0.010*				−0.011**
				(0.052)				(0.015)
*Relative$_{t-1}$ * Covid_crisis*	*−0.003*	*−0.001*	*−0.005*	*−0.002*	*0.004*	*0.007*	*−0.001*	*0.005*
	(0.816)	*(0.909)*	*(0.644)*	*(0.867)*	*(0.674)*	*(0.450)*	*(0.898)*	*(0.664)*
Covid_crisis	0.025***	0.025***	0.026***	0.025***	0.027***	0.026***	0.029***	0.027***
	(0.004)	(0.003)	(0.005)	(0.005)	(0.001)	(0.000)	(0.000)	(0.001)
Control included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.108***	0.105***	0.114***	0.108***	0.071**	0.067*	0.077**	0.069*
	(0.006)	(0.008)	(0.004)	(0.006)	(0.048)	(0.063)	(0.030)	(0.053)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,892	1,892	1,892	1,892	1,892	1,892	1,892	1,892
R-squared	0.159	0.159	0.159	0.159	0.129	0.129	0.129	0.129
Wald Chi 2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

This table presents OLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period, employing relative measures of CSR performance. Panel I reports results for models without interactions and Panel II reports those for models with interactions. In each Panel I and II, the dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Panel A: Idiosyn_R) and Systematic Tail Risk (Panel B: Sys_R). The main independent variable is the CSR performance measured by four different relative proxies: relative ES score (Relative ES_Refinitiv$_{t-1}$), Relative Environment score (Relative Environment_Refinitiv$_{t-1}$), Relative Social score (Relative Social_Refinitiv$_{t-1}$), and Relative ESG score (Relative ESG_Refinitiv$_{t-1}$). The inclusion of interaction terms between CSR performance and Covid dummy (Relative$_{t-1}$ * Covid_crisis) aims to test the differential effects between COVID and Pre-COVID periods. A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1 %, 5 % and 10 %, respectively. Table 1 reports full definitions and measurements of all variables.

Table 9
Tail Risk and CSR Performance by Bank Size Group: Post-2010 (post-crisis 2010–2020) Period.

VARIABLES	Panel A: Large Banks Idiosyncratic Tail Risk (Idiosyn_R) (1)	Systematic Tail Risk (Sys_R) (2)	Panel B: Small Banks Idiosyncratic Tail Risk (Idiosyn_R) (3)	Systematic Tail Risk (Sys_R) (4)
ES_Refinitiv $_{t-1}$	−0.019**	−0.016**	0.003	−0.005
	(0.013)	(0.036)	(0.688)	(0.540)
Covid_crisis	0.008	0.011	0.010	0.007
	(0.346)	(0.168)	(0.173)	(0.300)
Controls included	Yes	Yes	Yes	Yes
Constant	0.296***	0.189**	0.151***	0.138***
	(0.005)	(0.048)	(0.005)	(0.006)
Year fixed effect	Yes	Yes	Yes	Yes
Observations	920	920	855	855
R-squared	0.105	0.109	0.054	0.067
Chow test (p-value)				
Idiosyn_R	0.000***			
Sys_R	0.085*			

This table presents OLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period, by bank size group. Panel A reports results for large banks and Panel B reports those for small banks. In each panel, the dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Idiosyn_R) and Systematic Tail Risk (Sys_R). The main independent variable is the CSR performance measured by ES score (ES_Refinitiv$_{t-1}$). A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

where *i* stands for banks and *j* stands for the whole banking sector. Accordingly, four relative indices for ESG rating are created, and based on these, we could examine a bank's ESG rating relative to other banks in our full banking-sector sample for post-crisis time. The results are reported in Table 8 (Panels A and B). We again find consistent results with our main and alternative tests above. Specifically, we find that, after the financial crisis of 2007–2009, the relative ESG performance of banks (i.e., the overall ES, ESG, and E ratings) tend to mitigate their tail risk across both measures except for relative social score (*Relative Social_Refinitiv$_{t-1}$*). Interactions between CSR activities and the COVID-19 dummy still show insignificant results.

5.3. Tail risk and CSR performance by bank Size group

Table 9 reports the regression results for ES ratings and bank tail risk, separating sample banks by their size (log of total assets ≥ 7.863 and < 7.863). The cutoff of 7.863 is the median value of the *Size* variable. Specifically, we investigate the effects of bank size on the ES rating–tail risk nexus by splitting our post-crisis full sample into the large bank subsample (Panel A) and the small bank subsample (Panel B).

Our results show that larger banks have significantly stronger associations than their smaller counterparts. This is evidenced by the negative and significant coefficients of *ES_Refinitiv$_{t-1}$* on both idiosyncratic and systematic tail risk in Panel A or for larger banks. Such coefficients are insignificant in the subsample of smaller peers. The Chow test confirms the significant difference in coefficients between the two groups. We conclude that our main findings are likely to be driven by larger banking firms. A potential rationale for this finding is that investment in CSR can be a less considerable amount for large banks and hence less likely to be detrimental to their financial aspects. Given that ethical investors still aim to balance both financial (explicit) and nonfinancial (implicit) investment goals, relational wealth can be created and perceived better because of CSR investment.

5.4. Tail risk and CSR performance by financial freedom levels

We finally test whether the levels of a country's financial freedom affect our main findings. To do so, we split our sample into two subsamples: more financial freedom and less financial freedom. The cutoff is the median value of the *Financial_Freedom* variable (0.5): countries with a *Financial_Freedom* value over 0.5 are classified as having more financial freedom, otherwise less financial freedom. Table 10 (Panel A and Panel B) reports the results for the subsample of more financially free and less financially free countries, respectively. Models 1 and 3 report regression results for idiosyncratic tail risk, while models 2 and 4 present the results for systematic tail risk. We find that our main results (i.e., negative association between ES ratings and bank tail risk) are driven by banks headquartered in more financially free countries. This is evidenced by the negative and significant coefficient estimates of *ES_Refinitiv$_{t-1}$* on tail risk in Panel A, models 1 and 2. The Chow test confirms the significant difference in coefficients between the two groups.

6. Endogeneity treatments

6.1. Instrumental variable Estimations: GMM, 2SLS, and 3SLS

We treat the possible endogeneity issue from the relationship between bank risk (tail risk in our study) and CSR performance (e.g., Wu and Shen, 2013) by employing three common instrumental variable (IV) estimation techniques: GMM, 2SLS, and 3SLS. Given that the endogeneity problem could occur from causal links, while superior CSR performance could reduce bank tail risk, banks with low tail risk could also choose to engage in more CSR activities. Therefore, we first consider GMM which uses the first differences and lags all potential endogenous variables (e.g., CSR) that play the role of internal IVs. We then use 2SLS and 3SLS as alternative endogeneity treatment approaches, which are argued to be better than GMM in terms of selecting IVs. Indeed, when using these two methods, we need to find an external IV that is correlated with the endogenous variables (e.g., CSR) but uncorrected with the error terms. In this study, we followed the literature (e.g., John et al., 2008; Laeven and Levine, 2009; Andginer et al., 2014; Safiullah and Shamsuddin, 2018; Trinh et al., 2020) and chose the year average of the ES rating variable of other banks in the same country for our sample as an IV in all IV estimation models. The underlying logic of this choice is that the average CSR performance of other banks in the same year is unlikely to be affected by a change in a bank's tail risk. Diagnostic tests in Table 11 show that the chosen IV is valid, and endogeneity problems exist. Results are also reported in this table, and we find that across all models, our main findings are consistent and unchanged.

6.2. Propensity score matching analysis

In this section, we use PSM analysis, which involves the matching observations technique on the probability of undergoing treatment (here the probability of having high ES rating or high CSR performance) to confront self-selection bias and endogeneity (e.g., the possibility that banks with low tail risk pursue high CSR activities, leading to a causal relationship). The PSM approach was initially introduced by Rosenbaum and Rubin (1983) and developed further by several studies (e.g., Lawrence et al., 2011; Trinh et al., 2020; Trinh et al., 2021). Both univariate and multivariate analyses are conducted to obtain a better estimation of the linkage between bank tail risk and ESG rating. More specifically, we estimate the impact of ES ratings of banks on their tail risk by comparing the risk (idiosyncratic and systematic tail risk) of banks that have higher ES scores (treatment group) with that of their peers with lower ES scores (control group). We conduct this quasi-experiment by matching each high–ES score bank with one or more of their low–ES score counterparts sharing similar characteristics as shown by their propensity scores. The impact of the ES performance of banks on tail risk is estimated by the average difference between the high-ES banking group and the matched control group. In addition, we employ the probit technique to estimate the propensity score of a bank, in which the dependent variable is high ES rating performance (the indicator for whether the bank has high ES rating: *HighES_Dummy*, which has a value of one if a bank has high ES rating (greater than or equal to the mean *ES_Refinitiv*) and zero otherwise (less than mean *ES_Refinitiv*), and the independent variables are the bank characteristics from our main model.

When matching observations, we employ-four different techniques. First, we utilise one-to-one matching without replacement. This technique refers to the match of each high–ES rating bank (treatment group) with the nearest low–ES rating control bank (untreated group). It ensures that we do not have multiple low–ES rating banks assigned to the same high–ES rating bank, which can result in a smaller untreated group than the treated one. Second, we also utilise the approach of one-to-one matching with replacement, which differs from one-to-one matching without replacement in that we can match each treated high–ES rating bank to the nearest low–ES bank even if we use the control bank (the latter) more than once (see Dehejia and Wahba, 2002; Berger et al., 2015). Third and fourth, two other techniques (i.e., nearest-neighbour matching with n = 2 and n = 3 with replacement) are employed. By using these, we can match each high–ES rating bank with the two and three low–ES rating banks with the closest propensity scores, respectively.

Table 10
Tail Risk and CSR Performance by Financial Freedom Levels: Post-2010 (post-crisis 2010–2020) Period.

VARIABLES	Panel A: More Financial Freedom Level Idiosyncratic Tail Risk (Idiosyn_R) (1)	Systematic Tail Risk (Sys_R) (2)	Panel B: Less Financial Freedom Level Idiosyncratic Tail Risk (Idiosyn_R) (3)	Systematic Tail Risk (Sys_R) (4)
ES_Refinitiv $_{t-1}$	−0.024**	−0.021**	0.026*	0.018
	(0.027)	(0.050)	(0.060)	(0.174)
Covid_crisis	0.012*	0.011	0.007	0.007
	(0.100)	(0.108)	(0.424)	(0.420)
Controls included	Yes	Yes	Yes	Yes
Constant	0.137*	0.085	−0.018	−0.080
	(0.052)	(0.206)	(0.830)	(0.326)
Year fixed effect	Yes	Yes	Yes	Yes
Observations	1,075	1,075	700	700
R-squared	0.148	0.122	0.189	0.146
Chow test (p-value)				
Idiosyn_R	0.100*			
Sys_R	0.090*			

This table presents OLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period, by financial freedom levels. Panel A reports results for more financial freedom countries and Panel B reports those for less financial freedom countries. In each panel, the dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Idiosyn_R) and Systematic Tail Risk (Sys_R). The main independent variable is the CSR performance measured by ES score (ES_Refinitiv$_{t-1}$). A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables.

Table 11
Endogeneity Treatment: GMM, 2SLS and 3SLS - Post-2010 (post-crisis 2010–2020) Period.

Variable	Panel A: GMM Idiosyncratic Tail Risk (Idiosyn_R) (1)	Systematic Tail Risk (Sys_R) (2)	Panel B: 2SLS Idiosyncratic Tail Risk (Idiosyn_R) (3)	Systematic Tail Risk (Sys_R) (4)	Panel C: 3SLS Idiosyncratic Tail Risk (Idiosyn_R) (5)	Systematic Tail Risk (Sys_R) (6)
ES_Refinitiv $_t$	−0.076**	−0.084***	−0.011**	−0.013**	−0.036**	−0.037**
	(0.021)	(0.004)	(0.049)	(0.013)	(0.038)	(0.026)
ES_Refinitiv $_t$* Covid_crisis	0.005	0.012	0.006	0.016	0.004	0.014
	(0.887)	(0.519)	(0.632)	(0.191)	(0.771)	(0.324)
TailR $_{t-1}$	0.316**	0.002*				
	(0.029)	(0.088)				
Controls included	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.014*	0.200	0.123***	0.097***	0.085**	0.070*
	(0.098)	(0.177)	(0.001)	(0.007)	(0.033)	(0.063)
Observations	1892	1892	2,019	2,019	2481	2481
R-Square			0.042	0.049	0.026	0.065
Wald Chi 2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
AR(1)	0.000	0.024				
AR(2)	0.976	0.182				
Hansen Test (p-value)	0.119	0.959				
Endogenous test (p-value)			0.000	0.000		
First stage (F-test p-value)			0.060	0.010		
Breusch-Pagan LM Test (p-value)					0.000	0.000

This table presents GMM, 2SLS and 3SLS regression results for the effects of CSR performance on bank tail risk post-2010 (post-crisis 2010–2020) period. Panel A reports results using GMM and Panels B and C reports those using 2SLS and 3SLS respectively. In each panel, the dependent variables includes two types of tail risk: Idiosyncratic Tail Risk (Idiosyn_R) and Systematic Tail Risk (Sys_R). The main independent variable is the CSR performance measured by ES score ($ES\_Refinitiv_{t-1}$). The inclusion of interaction terms between CSR performance and Covid dummy ($Relative_{t-1}$ * Covid_crisis) aims to test the differential effects between COVID and Pre-COVID periods. A set of firm-level and country-level variables are included to capture the influences of firm and country characteristics on banking tail risk. ***, **, and * denotes the significance level of 1%, 5% and 10%, respectively. Table 1 reports full definitions and measurements of all variables. We obtained consistent results for Asset risk (SdROA) models. Unreported results will be provided upon request.

We first report the univariate analysis results (those using the above four techniques of matching) on the impact of CSR performance on bank tail risk. We present the mean differences (Panel A) between idiosyncratic (Panel I of Table 12) as well as systematic (Panel II of Table 12) tail risk of high–ES rating banks and those of their matched low–ES rating peers. We report *t*-statistic*s* for the differences in bank tail risk between high– and low–ES rating banks for each of the four propensity matching techniques. Employing one-to-one matching without replacement, we find that both the idiosyncratic tail risk and systematic tail risk of banks are 0.6 % lower for high–ES rating banks than for their low–ES rating peers. That difference is significant at the 1 % level. Results for other three matching methods show significant differences (at 1 %, 5 %, or 10 %) in idiosyncratic tail risk (systematic tail risk) at 1 % (1.1 %), 0.7 % (0.7 %), and 0.6 % (0.6 %), respectively.

In Panel B of both Panels I and II of Table 12, we conduct the average treatment effect on the treated (ATT) with one-to-one nearest-neighbour matching and bootstrapping of standard errors (i.e., 100, 1,000, and 10,000 replications) and find that the observed difference is − 0.007 (Panel I) and − 0.008 (Panel II) respectively, with high *t*-statistics showing statistical significance. Regarding the multivariable analysis, we report the regression results for the effects of the high–ES rating variable on bank tail risks (including control variables) in Panel C of both Panels I and II. In all matched samples (models 1–4), we also find negative and significant coefficient estimates on high ES rating given that all the above results are for the post-crisis period only. We therefore consistently conclude that for the post-crisis period (2002–2020), banks with higher ES rating exhibit lower tail risks.

7. Concluding remarks

In this paper, we examine the association between CSR and tail risk (i.e., the likelihood of extreme stock devaluation) during normal and disruptive market conditions. The study covers the 2002–2020 period, which is divided into pre-crisis (2002–2009) and post-crisis (2010–2020) periods using a global banking sample of 244 listed commercial banks traded in 52 stock markets. Since the crisis has been recorded as a genuine external market shock that has critically heightened the focus and scrutiny of investors, academic researchers, and other practitioners on the CSR conduct of the banking industry, our study offers a solid foundation and motivation to examine the value-enhancing contribution of CSR through the reduction of bank tail risk during the pre-2010 (pre-crisis) and post-2010 (post-crisis) periods.

Our results show no significant effect of CSR intensity (as measured by ES rating as the primary proxy, which focuses on ES scores and omits governance ratings) on banking tail risk in the pre-2010 period. Nevertheless, the stock market appears to perceive the ES rating of those banks after the financial crisis. This is empirically evidenced by our main findings addressing post-2010 (2010–2020) bank tail risk and ES performance. In particular, results indicate that for this post-crisis period, banks with high social capital or CSR

Table 12
Propensity Score Matching (PSM) estimation: Post-2010 (post-crisis 2010–2020) Period Do Banks with High CSR Performance exhibit lower Tail Risk?

Dependent variable: Idiosyncratic Tail Risk (Idiosyn_R) and Systematic Tail Risk (Sys_R)
Independent variables: HighES_Dummy, coded as 1 if a bank has high score of ES rating (>= mean ES_Refinitiv)

PANEL I: Idiosyncratic Tail Risk (Idiosyn_R)
Panel A: Average treatment effects (ATE) with nearest neighbor matching method

		Treated	Control	Δ	S.E.	*T*-stat
1:1 matching without replacement						
	Unmatched	0.056	0.058	−0.002	0.002	−1.17
	Matched	0.055	0.061	−0.006***	0.002	−2.44
1:1 matching with replacement						
	Unmatched	0.056	0.058	−0.002	0.002	−1.17
	Matched	0.055	0.065	−0.010***	0.004	−2.46
Nearest neighbor (n = 2)						
	Unmatched	0.056	0.058	−0.002	0.002	−1.17
	Matched	0.055	0.062	−0.007***	0.004	−2.07
Nearest neighbor (n = 3)						
	Unmatched	0.056	0.058	−0.002	0.002	−1.17
	Matched	0.055	0.061	−0.006*	0.003	−1.71
Panel B: Average treatment effect on the treated (ATT) with 1:1 nearest neighbor matching and bootstrapping of standard errors						
	No of treated obs.	Replications	Observed (Δ)	Bias	S.E.	*T*-stat
	845	100	−0.007***	0.001	0.004	−2.006
	845	1000	−0.007**	0.001	0.004	−1.943
	845	10,000	−0.007***	0.002	0.003	−2.405
Panel C: Regression results on matched samples						
	(1)	(2)	(3)	(4)		
Independent variables	1:1 matching without replacement	1:1 matching with replacement	Nearest neighbor (n = 2)	Nearest neighbor (n = 3)		
HighES_Dummy	−0.006**	−0.010***	−0.007***	−0.006**		
	(0.020)	(0.000)	(0.006)	(0.026)		
Controls	Yes	Yes	Yes	Yes		
Constant	0.062*	0.124***	0.087**	0.078**		
	(0.060)	(0.000)	(0.021)	(0.027)		
R-squared	0.008	0.018	0.010	0.010		
Observations	1506	1506	1314	1427		
PANEL II: Systematic Tail Risk (Sys_R)						
Panel A: Average treatment effects with nearest neighbor matching method						
		Treated	Control	Δ	S.E.	*T*-stat
1:1 matching without replacement						
	Unmatched	0.050	0.054	−0.003**	0.002	−1.94
	Matched	0.050	0.056	−0.006***	0.002	−2.84
1:1 matching with replacement						
	Unmatched	0.050	0.054	−0.003**	0.002	−1.94
	Matched	0.050	0.061	−0.011***	0.004	−2.85
Nearest neighbor (n = 2)						
	Unmatched	0.050	0.054	−0.003**	0.002	−1.94
	Matched	0.050	0.057	−0.007***	0.003	−2.22
Nearest neighbor (n = 3)						
	Unmatched	0.050	0.054	−0.003**	0.002	−1.94
	Matched	0.050	0.055	−0.006**	0.003	−1.94
Panel B: Average treatment effect on the treated with 1:1 nearest neighbor matching and bootstrapping of standard errors						
	No of treated obs.	Replications	Observed (Δ)	Bias	S.E.	*T*-stat
	845	100	−0.008***	0.001	0.003	−2.367
	845	1000	−0.008***	0.002	0.003	−2.414
	845	10,000	−0.008***	−0.002	0.003	−2.386
Panel C: Regression results on matched samples						
	(1)	(2)	(3)	(4)		
Independent variables	1:1 matching without replacement	1:1 matching with replacement	Nearest neighbor (n = 2)	Nearest neighbor (n = 3)		
HighES_Dummy	−0.007***	−0.010***	−0.007***	−0.006***		
	(0.005)	(0.000)	(0.002)	(0.010)		
Controls	Yes	Yes	Yes	Yes		
Constant	0.044	0.097***	0.058*	0.051		
	(0.143)	(0.003)	(0.093)	(0.114)		
R-squared	0.008	0.024	0.012	0.011		
Observations	1506	1506	1314	1427		
Observations	1724	1724	2208	2712		

intensity had lower idiosyncratic and systematic tail risk or a lower possibility of severe suffering from market downturns. These findings are robust across alternative measures of CSR performance (e.g., environment rating, ESG ratings, and relative measures of CSR) and different empirical approaches (e.g., endogeneity treatments and PSM). Overall results suggest that the trust between a bank and its investors emerges through the bank's investment in social capital or CSR when it experiences a negative global financial shock. This study offers several practical applications in different areas, typically banks' risk management, through the facilitation of risk managers' portfolio specifications.

Our study contributes to the ongoing debates not only on the value-maximising attributes of CSR but also on its risk management function, particularly in the banking industry. Future research may consider focusing on this risk management function of CSR since it is critical for the industry per se and for the whole economic and financial system. Furthermore, additional attempts would be helpful in clarifying specific practical circumstances in which the implications of our CSR–tail risk findings hold true. Finally, it would be intriguing for future research to examine other exogenous shocks, such as regulatory changes, that may influence the impacts of CSR on tail risk. This will provide banks with greater insight into setting up effective strategic risk management using CSR.

CRediT authorship contribution statement

Vu Quang Trinh: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Writing – original draft, Writing – review & editing. **Ngan Duong Cao:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Software, Writing – original draft, Writing – review & editing. **Teng Li:** Conceptualization, Project administration, Resources, Writing – original draft, Writing – review & editing. **Marwa Elnahass:** Project administration, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

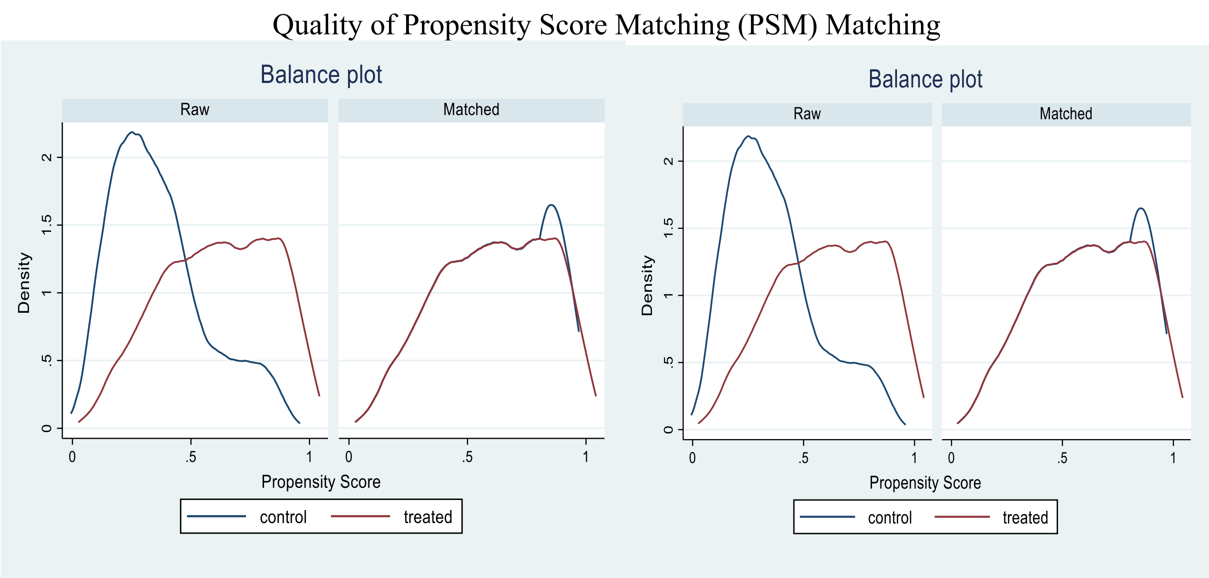
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A

Quality of Propensity Score Matching (PSM) Matching.
See Fig. A1.



Idiosyncratic Tail Risk (Idiosyn_R) **Systematic Tail Risk (Sys_R)**

Fig. A1.

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