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ESG and Systemic Risk

George-Marian Aevoae
Alexandru Ioan Cuza University of Iasi

Alin Marius Andries
Alexandru Ioan Cuza University of Iasi

Steven Ongena
University of Zurich, KU Leuven, Swiss Finance Institute, and CEPR

Nicu Sprincean
Alexandru Ioan Cuza University of Iasi

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George Marian Aevoae
Alexandru Ioan Cuza University of Iași

Alin Marius Andrieș
Alexandru Ioan Cuza University of Iași and *Institute for Economic Forecasting, Romanian Academy*

Steven Ongena
University of Zurich, Swiss Finance Institute, KU Leuven,
NTNU Business School, and *CEPR*

Nicu Sprincean
Alexandru Ioan Cuza University of Iași and *National Institute for Economic Research, Romanian Academy*

Abstract

How do changes in Environmental, Social and Governance (ESG) scores influence banks' systemic risk contribution? Using a dynamic panel model, we document a beneficial impact of the ESG Combined Score and Governance pillar on banks' contribution to system-wide distress analysing a panel of 367 publicly listed banks from 47 countries over the period 2007-2020. Stakeholder theory and theory relating social performance to expected returns in which enhanced investments in corporate social responsibility mitigate bank specific risks explain our findings. However, only better corporate governance represents a tool in reducing bank interconnectedness and maintaining financial stability. The results are robust to alternative measures of systemic risk, both contribution and exposure, as well as when estimating a static model. Our findings stress the importance of integrating banks' ESG disclosure into regulatory authorities' supervisory mechanisms as qualitative information.

Keywords: Systemic Risk; Financial Stability, Corporate Social Responsibility (CSR), Environmental, Social and Governance (ESG) Scores
JEL classification: G01, G21, M14

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1. Introduction

Climate change-related shocks and environmental degradation have an important impact on society, pose both microprudential and macroprudential risks and affect both the economy and the financial system (Brunetti et al., 2021). Climate change is considered an emerging threat to the financial stability by authorities (see, e.g., BIS, 2021; ESRB, 2021; FSOC, 2021) and risks generated by the climate-related events are systemic (Battiston et al., 2021). To identify risks that may negatively impact investors or the stability of financial markets on a timely basis, authorities should rely also on a sound understanding of Environmental, Social and Governance (hereafter, ESG) markets (ESMA, 2022). The transmission channels of climate change risk to the financial sector comprise physical climate risks (e.g., severe weather events such as floods that impair directly productive assets), transition risks (e.g., involve risks to cash flows emerging from transition to a greener economy) and liability risks (e.g., risks stemming from the compensations paid to economic agents due to losses they may have incurred from the physical or transition risks) (BoE, 2018). To monitor and mitigate these risks, the European Central Bank (ECB) designed in 2022 the first ever climate risk stress test to assess how prepared are European banks in facing climate-related events (ECB, 2022), whereas the European Banking Authority (EBA) introduced a template for largest banks that will have to disclose their ESG exposure starting with 2023 (EBA, 2022).

In a world where the trust in the banking system was majorly shaken by scandals like the collapse of Lehman Brothers or LIBOR manipulation, banks' investments in social responsibility can be seen as trust building commitments (Park et al., 2014). Broadly, ESG refers to how companies and investors include environmental, social and governance aspects into their business models (Gillan et al., 2021) and can affect reputation of financial institutions (Murè et al., 2021).[1] Although previous empirical research has found beneficial effects of environmental, social and governance practices on different aspects of companies, such as performance or risk, these findings refer especially to non-financial corporations (e.g., Bouslah et al., 2018; Liu et al., 2021). Despite a substantial stream of empirical evidence that indicates a positive influence of sustainable strategies on banks' profitability (Cornett et al., 2016; Gangi et al., 2019) and individual risk,

[1] ESG scores are used in the empirical literature as proxies for Corporate Social Responsibility (hereafter CSR) performance (see, e.g., Sassen et al., 2016; Chiaramonte et al., 2021). However, Gillan et al. (2021) point-out that ESG is a more expansive term that CSR, the main distinction between the two being that ESG incorporates governance aspects explicitly, whereas CSR includes governance in an indirect manner.

measured both *ex-ante* through option-implied volatility (Kim et al., 2021) and *ex-post* by using standard deviation of stock returns, systematic risk (beta), distance to default, or z-score (Bouslah et al., 2013; Albuquerque et al., 2019; Chiaramonte et al., 2021; Neitzert and Petras, 2021)[2], the literature examining the impact on the systemic risk is much scarcer and provides inconclusive results (Anginer et al., 2018; Scholtens and van't Klooster, 2019; Cerqueti et al., 2021). Anginer et al. (2018) show that policies that are shareholder-friendly, which are associated with a higher corporate governance score, tend to amplify bank systemic behaviour. On the other hand, Scholtens and van't Klooster (2019) report that high sustainability scores reduce banks' systemic risk contribution - the social pillar being the main driver, and Cerqueti et al. (2021) argue that ESG investing leads to a reduction of systemic risk, investors in socially responsible funds being less sensitive to past negative returns than their peers that invest in conventional funds (Renneboog et al., 2011).

There are three theories that explain the relationship between corporate social responsability and firm risk (Bouslah et al., 2018): (i) the stakeholder theory in which enhanced investments in CSR have the potential to generate moral capital or goodwill (i.e., intangible assets) among stakeholders, acting like insurance protection mechanisms that lessens firms' risk exposure, mitigating operational, environmental and social risks (i.e., risk mitigation view) (El Ghoul and Karoui, 2017);[3] (ii) theoretical models that assess the linkage between social performance and expected return, in which investors make investment decisions based on both financial and non-financial criteria, and predicts that socially responsible companies attract more investors, thus lowering their risks (Lee and Faff, 2009); and (iii) managerial opportunism theory which states that CSR expenditures act as a waste of resources, decreasing the net worth of the company (i.e., overinvestment view) (Barnea and Robin, 2010).

Financial institutions are associated with a key role in CSR practices (Scholtens, 2006), that have the potential to enhance their reputation (Forcadell and Aracil, 2017). Besides financial information gathered in assessing potential clients and projects, they also make use of non-financial characteristics (Denis, 2004). Non-financial information may relate to social, ethical and environmental aspects of borrowers that will ultimately reduce both direct and indirect risks related

[2] More recently, Lööf et al. (2022) show that ESG ratings are associated with lower downside risk, but also with lower upside return potential.
[3] However, as argued by Peloza (2006), insurance value from sustainable practices varies across industries in which companies operate, and also depends on their age.

to banks' lending activities in case they take possession of collateral that can bear costs in case is not environmentally friendly or be exposed to borrowers' solvency issues due to breaches of environmental standards (Thompson and Cowton, 2004; Scholtens, 2006). In addition, CSR disclosure helps reducing cost and information asymmetry between managers and external stakeholders (Cormier et al., 2011).

In this paper, we adopt the first two theories in explaining the CSR and firm risk nexus and examine how ESG attributes, as well as individual ESG pillars, relate to banks' systemic risk contribution. Using data for 367 banks from 47 countries for a period of 14 years (2007-2020), we document a beneficial impact of ESG strategies on banks' contribution to financial system risk, the main driver being the governance pillar. These findings hold for alternative measures of systemic risk contribution, as well as exposure to system-wide distress, and are robust to different models, both static and dynamic. In addition, we find that large banks and those located in advanced markets benefit more from a sustainable behaviour.

Our study makes three important contributions to the extant literature. First, it adds to the growing body of empirical investigations on the determinants of systemic risk and especially to the literature studying the impact of ESG-related information on banks' risk. We assess whether the ESG–bank systemic risk relationship is driven by other bank-level characteristics (e.g., size, capitalization), banking system (e.g., bank concentration) and macroeconomic variables (e.g., economic growth), shedding additional light on determinants of systemic risk. Second, we disentangle the aggregate effect by analyzing all pillars of ESG scores (that is, environmental, social and governance). We document a favorable impact of ESG Combined Score on contribution to system-wide distress and emphasize that this impact is driven especially by the Governance pillar. Our results confirm that the corporate governance represents a key tool in curbing bank interconnectedness and maintaining financial stability. Third, we provide more insights on the ESG-bank systemic risk nexus by analyzing a global sample of banks, that consists of banks situated in both developing and developed countries, as previous research is focused mainly on developed markets (Bahadori et al., 2021). As the ESG Combined Score hikes, banks' contribution to system wide-distress decreases, and our results reveal a more pronounced effect of sustainability on systemic risk for banks located in advanced countries.

The rest of this paper is organized as follows: In Section 2, we present the data and methodology employed. In Section 3, we discuss the empirical results and perform several robustness checks, and in Section 4 we conclude.

2. Data and methodology

2.1 Data

We assess the potential impact of changes in ESG attributes on systemic risk in a panel setting using bank-level data for 2007–2020 period. Our sample is based on the 593 banks located in 56 countries included in the RF Global Banks index from Thomson Reuters Eikon.[4] We have dropped banks with missing data necessary for systemic risk computation or ESG scores throughout the analyzed period in the Thomson Reuters Eikon or Worldscope databases. The final sample used in the empirical analysis is composed of 367 publicly listed banks from 47 countries with the mean size of USD 274 billion at the end of 2020. We use both large and small banks because smaller institutions can have a systemic behaviour being part of a herd (Brunnermeier et al., 2009).

2.2 Measure of banks' systemic risk contribution

We employ as our main systemic risk contribution indicator Delta-Conditional Value at Risk (ΔCoVaR) developed by Adrian and Brunnermeier (2016), which is widely used in the literature.[5] This metric is developed based on the Value at Risk (VaR) indicator and is conditional on several common factors representative for the global financial markets. Financial system's conditional VaR (CoVaR) when a bank *i* experiences a tail event is given by:

$$\Pr\left(R^{System} \leq CoVaR_{5\%}^{System|i} \middle| R^{i} = VaR_{5\%}^{i}\right) = 5\% \quad (1)$$

where R^{System} denotes the log-return of the financial system (market) and R^{i} is the log-return for bank *i*. In the end, each bank's contribution to systemic risk (ΔCoVaR) is defined as the difference between VaR of the financial system conditional on the event that the bank registers the lowest return at the 5% confidence level and VaR of the financial system conditional on the event that the bank faces the median return (50%):

$$\Delta CoVaR_{5\%}^{System|i} = CoVaR_{5\%}^{System|i=VaR_{5\%}^{i}} - CoVaR_{5\%}^{System|i=VaR_{50\%}^{i}} \quad (2)$$

[4] Ticker LX4GLBK$.
[5] Recent surveys are provided by Benoit et al. (2017) and Silva et al. (2017).

To compute time-varying ΔCoVaR, we follow Bostandzic and Weiß (2018) and sample the conditioning variables from the US market because they are representative for the global financial system due to the strong degree of globalization in the financial industry and the predominance of the US economy (López-Espinosa et al., 2012).[6] The state variables are lagged one period to account for the speed of adjustment and are stationary as revealed by the Augmented Dickey-Fuller and Phillips-Perron tests: (i) the log-return of MSCI World index; (ii) the S&P 500 implied volatility index (VIX); (iii) the real estate sector log-return (MSCI World Real Estate) in excess of the financial sector log-return (MSCI World Financials); (iv) the first difference of the US three-month Treasury Bill rate; (v) the first difference of the TED spread; (vi) the first difference of the spread between the US 10-year bond yield and three-month Treasury Bill rate; and (vii) the first difference of the spread of the US Moody's Baa corporate bond yield and 10-year bond yield. Similarly to Bostandzic and Weiß (2018), we proxy global financial sector portfolio by MSCI World Financials index. We use the Quintile Regression (Koenker and Bassett, 1978) to estimate the 5% quantile corresponding to distressed periods as suggested by Adrian and Brunnermeier (2016), in which standard errors display asymptotic validity in the presence of heteroskedasticity and misspecification (Machado and Santos Silva, 2013). We estimate ΔCoVaR using data with daily frequency and average it, similarly to Laeven et al. (2016) and Bostandzic and Weiß (2018), to obtain annual values. Higher values for ΔCoVaR denote an enhanced contribution of banks to overall systemic financial risk, and thus increased interlinkages between banks.

[Figure 1 goes here]

Figure 1 exhibits the average ΔCoVaR by country for banks from our sample over the period 2007-2020, as well as the average by year. The banks that were the biggest contributors to systemic risk were those from France, Germany, and Netherlands, whereas the least contributors were banks located in Philippines, Morocco, and Pakistan. In terms of period, in 2008, 2009 and 2020 ΔCoVaR displayed the largest values, corresponding to the global financial crisis episode (2008 and 2009) and the COVID-19 shock (2020).

[6] Xu et al. (2019) employ separately regional and global state variables and find the results to be very similar.

To test the robustness of our findings, we employ several alternative measures to capture banks' systemic behavior. Systemic Risk Index (SRISK) introduced by Acharya et al. (2012) and extended to a conditional framework by Brownlees and Engle (2017) measures the contribution of a bank to system-wide risk, defined as the loss of a specific bank in terms of capital shortfall, conditioned by a severe market decline. SRISK is defined as follows:

$$SRISK_t^i = kL_t^i - (1-k)E_t^i\left(1 - LRMES_t^i\right) \quad (3)$$

where k is the prudential capital ratio set at 8% in line with Brownlees and Engle (2017),[7] L_t^i is the book value of total liabilities, E_t^i is the market capitalization of the bank (market value of equity), and $LRMES_t^i$ is the long-run marginal expected shortfall, i.e. the expectation of the bank equity multi-period return conditional on the systemic event. Following Brownlees and Engle (2017), we compute LRMES without simulation as $1 - \exp$ (log $(1-d) \times\ beta$), where *d* is the six-month crisis threshold for the market capitalization of the sample decline set at 40%, and *beta* is the bank's beta coefficient. Positive values for SRISK implies capital shortfall (insufficient working capital), whereas negative values are associated with capital surplus (no distress). Following Laeven et al. (2016) we do not set negative values to zero because they are useful in capturing the relative contribution of the banks to systemic risk. Similar to Berger et al. (2020), we normalize banks' SRISK by their market capitalization to obtain normalized SRISK (NSRISK), denoting capital shortfall per unit of market capitalization. Furthermore, we compute Systemic Factor as principal-component factor using factor analysis based on ΔCoVaR and NSRISK and employ it as alternative proxy for systemic risk contribution.

Finally, we introduce Exposure-ΔCoVaR (eΔCoVaR) as a measure of systemic risk exposure which works in the opposite direction with ΔCoVaR, denoting system's contribution to bank *i*, being defined as follows:

$$e\Delta CoVaR_{5\%}^{i|R^{System}} = CoVaR_{5\%}^{i|System=VaR_{5\%}^{System}} - CoVaR_{5\%}^{i|System=VaR_{50\%}^{System}} \quad (4)$$

Higher values of eΔCoVaR indicate greater exposure of banks to systemic distress.

[7] Brownlees and Engle (2017) show that the findings are substantially stable when changing prudential capital ratio to different values.

2.3 Environmental, Social and Governance scores

In line with previous studies (Sassen et al., 2016; Scholtens and van't Klooster, 2019; Chiaramonte et al., 2021; Neitzert and Petras, 2021), we use ESG scores as proxy for corporate social responsibility. We gather overall composite score (ESG Combined Score) and its three pillars (Environmental, Social and Governance) from Thomson Reuters Eikon which are based on a new methodology developed in 2017 called TR ESG Refinitiv that replaced the old Asset4 ESG methodology.[8] The scores range from 0 to 100, higher values indicating more responsible ESG behavior, and are grouped into 10 categories and multiple themes based on publicly reported information as follows:[9] (i) Emissions (emissions, waste reduction, biodiversity and environmental management systems), Innovation (product innovation and green revenues, research and development and capital expenditure) and Resources use (water, energy, sustainable packaging and environmental supply chain) that form the Environmental pillar; (ii) Community involvement, Human rights, Product responsibility (responsible marketing, product quality and data privacy) and Workforce (diversity and inclusion, career development and training, working conditions and health and safety) that form the Social pillar; and (iii) CSR strategy (CSR strategy and ESG reporting and transparency), Management (structure, i.e., independence, diversity and committees, and compensation), and Shareholders (shareholder rights and takeover defenses) that form the Governance pillar. Environmental and Social categories are given specific weights depending on industry group using data-driven and objective logic, whereas for the Governance pillar the weights remain the same across all industries (see Refinitiv, 2022 for more details).[10] In the end, the ESG Score is the relative sum of the category weights. The ESG Combined Score is then computed as the average of the ESG score and ESG controversies score when there are controversies during the fiscal year, based on 23 ESG controversy topics, which is used as our main indicator.[11] This comprehensive measure thus incorporates other negative ESG-related events with the potential to enhance banks' systemic risk contribution through spillover effects. Wong and Zhang (2022) find that adverse media coverage on ESG issues has a significant and

[8] Given the multitude of providers of ESG ratings, Berg et al. (2021) propose a noise-correction procedure and confirm the positive impact of sustainable activities on stock returns, the results being even stronger than previously estimated in the literature.

[9] If an indicator is irrelevant for a particular sector, then it is excluded from the calculation.

[10] The weights are the following: CSR strategy – 0.13; Management – 0.67; Shareholders – 0.20.

[11] When the ESG Controversies Score is higher than the ESG Score, then the ESG Score is equal to the ESG Combined Score.

negative impact on firm valuation, banks being among the most susceptible to investors' repercussion.[12]

[Figure 2 goes here]

In Figure 2, which plots the average ESG Combined Score by country over the period 2007-2020, and by year, one can note that the most sustainable banks are those that have their headquarters in South Korea, Spain and Portugal, and the banks from Peru, Saudi Arabia, and Japan manifest a less desirable behavior towards sustainable practices.

2.4 Econometric framework

To capture the autoregressive structure of systemic risk, we employ the bias-corrected least-squares dummy variable (LSDVC) estimator developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005). Monte Carlo simulations have shown that the LSDVC tends to outperform the Instrumental Variable-Generalized Method of Moments (IV-GMM) estimators in terms of bias and root mean squared error. Thus, our main estimated model has the following form:

$$\Delta CoVaR_{ij,t} = \beta_0 \times \Delta CoVaR_{ij,t-1} + \beta_1 \times \Delta ESG_{ij,t-1} + \beta_2 \times Bank_{ij,t-1} + \beta_3 \times Country_{j,t-1} + \delta_i + \gamma_t + \varepsilon_{ij,t} \quad (5)$$

where $\Delta CoVaR_{ij,t}$ is the contribution to systemic risk of bank *i* from country *j* in year *t*, $\Delta ESG_{ij,t-1}$ is the main variable of interest that quantifies the change in Environmental, Social and Governance pillars, as well as ESG Combined Score, for bank *i* in year *t-1*. $Bank_{ij,t-1}$ is a $(k \times 1)$ vector of bank-level control variables, i.e., size (natural logarithm of Total Assets), capitalization (Common Equity/Total Assets), profitability (Return on Equity), lending activities (Total Loans/Total Assets), credit risk ratio (Non-Performing Loans/Total Loans), funding structure (Total Deposits/Total Liabilities) and income diversification (Non-Interest Income/Revenue) associated to systemic risk in the literature in year *t-1*, $Country_{j,t-1}$ is a $(k \times 1)$ vector that comprises control variables at the banking system-level (Bank Concentration), country-level characteristics (Real GDP Growth and Inflation), and the overall level of governance in a country based on Worldwide

[12] In other industries, such as fossil fuel firms, ESG activities are measured especially through carbon risk, proxied for instance by total fossil fuel reserves (Delis et al., 2021).

Governance Indicators (Governance Index[13]) in year *t-1*. δ_i are bank fixed effects to account to time-invariant heterogeneity across banks that may be related to systemic risk and to control for omitted variable bias which may be a cause for potential endogeneity issues, γ_t are time fixed effects to capture common shocks across banks (general uncertainty conditions, such as crises) (see Bai, 2009 and Chen and Chen, 2018), and $\varepsilon_{ij,t}$ is the error term. To reduce the problems caused by outliers, all variables are winsorized at the 1% of each tail of distribution.

In our empirical setting we employ independent variables that are lagged one period (year) to control for the speed of adjustment of systemic risk measures, as well as to account for potential endogeneity concerns deriving from reverse causality or simultaneity bias (Anginer et al., 2014; Neitzert and Petras, 2021). Table A1 in the Appendix describes the variables and the source of data, Tables A2, A3 and A4 exhibit summary statistics for the whole sample, large and small banks, respectively (see Section 3.2.5), Table A5 display averages by country for the 2007-2020 period, and Table A7 shows the correlation matrix of regressors.

3. Empirical results

3.1 Baseline results

The baseline results displayed in Table 1 show the negative and statistically significant impact of an increase of ESG scores on banks' contribution to systemic risk (i.e., an improvement of ESG score determines a reduction of banks' contribution to systemic risk). The table reports the results for the model described in Eq. (5) corresponding to the ESG Combined Score (Model (1)), as well as its pillars, i.e., Environmental (Model (2)), Social (Model (3)) and Governance (Model (4)). As the ESG Combined Score hikes, banks' contribution to system wide-distress decreases, in line with the previous results for individual risk. Thus, sustainable practices disclosure provides banks with insurance-like protection that encourage them engaging in prudent banking activities (e.g., selecting borrowers that are less risky from a CSR perspective and with innovative investment projects), acting also as reputational guarantee in relation with their customers and business partners (Gangi et al., 2019). Consequently, this prudent behaviour leads to a reduction in contribution to systemic risk because, as noted by de Haan and Vlahu (2016), excessive risk-taking by banks can translate into systemic risk and negative externalities. This finding is also

[13] The index is constructed as equally weighted average of the six dimensions of governance indicators.

economically meaningful: a one standard deviation increase in change in ESG Combined Score leads to a reduction of 1.4% of a standard deviation in ΔCoVaR. This is valid especially in the case of Governance pillar, whereas the impact of the other pillars turns out to be statistically insignificant. Our findings are consistent with those of Chiaramonte et al. (2021) who showcase a beneficial impact of banks' corporate governance on bank stability. In the same vein, Kiesel and Lücke (2019) find that ESG performance has a significant impact on the credit default swap (CDS) spread around the rating announcement date, where corporate governance seems to play the most important role.

[Table 1 goes here]

According to the stakeholder theory, the Governance pillar is positively linked with bank soundness due to the reduced motivation to pass-through risks (Kirkpatrick, 2009). Previous studies document that corporate governance plays an important role in reaching business success and shapes managerial behaviour through CSR strategies (Boubaker et al., 2020), different corporate governance structures impact differently risk-taking strategies (Laeven and Levine, 2009), and risk management-related corporate governance mechanisms are associatedwith a better mitigation of bank risks, both in developed and emerging countries (Ellul and Yerramilli, 2013; Andrieș and Brown, 2017). Moreover, Hamed et al. (2022) find that corporate governance improves mandatory CSR reporting quality. In terms of Environmental pillar, one should expect a weak relation for banks than for non-financial corporations (Chiaramonte et al., 2021). Although the literature finds a positive impact of implementing environmental issues in lending activities on banks' individual risk (Gangi et al., 2019) especially during crisis periods (Chiaramonte et al., 2021) because they may be perceived less risky, our findings do not point the same effect when it comes to contribution to system-wide distress. A possible explanation could lie in the fact that excluding debtors more exposed to changes in environmental practices and regulation influence banks' business models and forgo profitable investment opportunities. With reference to the Social pillar, investing in community, human rights, product responsibility and workforce does not reduce banks' contribution to systemic risk, although this happens in the case of individual risk (Chiaramonte et al., 2021).

In terms of control variables, the sign of the estimated coefficients is overall consistent with the existing literature. Larger banks are more complex and interconnected (Bostandzic and Weiß, 2018), thus being more prone to default (De Nicolo, 2001), in line with the "too-big-to-fail" hypothesis which states that these banks have a higher probability to be bailed-out by the government in the case of distress and may incentivize them to engage in riskier lending operations (Farhi and Tirole, 2012), thus creating moral hazard. Better-capitalized banks have a lower systemic risk contribution, in line with Laeven et al. (2016), given the fact that equity acts as buffer during adverse shocks, giving banks the possibility to finance themselves in difficult times when the funding costs are considerable higher, and thus to absorb more losses (Berger et al., 2009). Banks with diversified sources of revenue (that also focus on non-interest income, such as fees and trading profits) are profit and value-enhancing through economies of scale and risk-reducing due to revenue diversification benefits (Stiroh and Rumble, 2006). In terms of real GDP growth, that captures the stage of the business cycle, we document a positive link with banks' systemic importance, revealing that systemic risk starts to accumulate in the financial sector when the output gat is positive (Andrieș and Sprincean, 2021). A higher degree of governance, which measures the overall political and institutional quality of a country, manifests itself in a beneficial impact on banks' systemic behavior, consistent with Andrieș and Sprincean (2021).

Moreover, the autoregressive coefficients are all below 1 and highly significant, pointing to a strong persistence of ΔCoVaR.

3.2 Robustness checks

3.2.1 Alternative model

The model described by Eq. (5) is a dynamic one. To assess the consistency of our findings, we employ a different empirical strategy, i.e., a static model. Hence, we use the fixed effects estimator. To correct for autocorrelation and heteroskedasticity in the residuals standard errors are clustered at the bank level.

[Table 2 goes here]

The estimated results are showcased in Table 2 and are in line with our baseline findings (Table 1), pointing a beneficial impact of ESG Combined Score and Governance pillar on banks' systemic behavior.

3.2.2 Alternative measure for systemic risk contribution

Kleinow et al. (2017) show that different systemic risk indicators can produce conflicting results. To assess the robustness of our results, we employ a different systemic risk contribution measure. Systemic Risk Index (SRISK), proposed by Acharya et al. (2012) and extended to a conditional framework by Brownlees and Engle (2017), captures banks' capital shortfall measured in monetary units conditioned on the state of the financial system (proxied by MSCI World Financials index) being in distress. Similar to Berger et al. (2020), we normalize banks' SRISK by their market capitalization to obtain normalized SRISK (NSRISK), denoting capital shortfall per unit of market capitalization.

[Table 3 goes here]

[Table 4 goes here]

The findings are displayed in Table 3. The negative and significant effect of changes in ESG combined score on systemic risk contribution holds, but this time the beneficial impact is driven by the Social pillar, possibly reflecting the differences between the two indicators of banks' systemic risk contribution, with the ΔCoVaR measuring contagion risks and interconnectedness between banks and NSRISK quantifying the exposure to common shocks affecting the whole financial sector (Andrieș et al., 2022). Further, we compute Systemic Factor as principal-component factor using factor analysis based on ΔCoVaR and NSRISK in a similar approach to Berger et al. (2020). Through this one can generate new systemic risk indicators as linear combinations of the original factors by synthesizing the most important systemic risk information they carry. Results show a decrease in systemic risk contribution for ESG Combined Score and Governance pillar, consistent with our main outcome (Table 4).

3.2.3 Exposure to systemic risk

To examine how changes in ESG performance affect banks' exposure to systemic stress we employ the Exposure-ΔCoVaR which works in the opposite direction with ΔCoVaR, capturing financial system's contribution to banks, or, in other words, the exposure of banks to the financial system risk.

[Table 5 goes here]

We find the same impact as in the case of ΔCoVaR, with the main difference that this time the estimated coefficient Governance pillar, although with a negative sign, lacks statistical significance. As the ESG Combined Score becomes larger, banks' exposure to system-wide distress decreases. Thus, ESG attributes matter for both banks' contribution and exposure to financial system risk.

3.2.4 Additional robustness checks

To account for potential dependency due not nesting (banks nested in countries) and for data that has various levels of aggregation, we use a Hierarchical Linear Modeling (HLM) approach. This technique is suitable for unbalanced panels and does not require residuals to be independent (Mourouzidou-Damtsa et al., 2019). Moreover, instead of changes in ESG Combined Score index we employ this variable in levels because banks can have high or low levels of sustainability but with zero variation for several periods.[14]

[Table 6 goes here]

From Table 6 one can note that the results are consistent with our main findings (Table 1) for both HLM approach (Model (1)) and when using ESC Combined score in levels (Model (2)). In addition, we control for crisisperiods and the results turn out to be consistent (Model (3)).[15]

3.2.5 Sub-samples analysis

We disentangle the effect of changes in ESG performance on both contribution and exposure of banks to system-wide distress by looking separately at the behaviour of large and small banks.[16]

[14] We thank a referee for pointing-out this issue.

[15] Crisis periods are defined as 2008-2009 for non-European countries (Bouslah et al., 2018), and according to European Systemic Risk Board methodology for European states.

[16] Small and large banks are defined based on the median size (total assets) of the sample in 2020, with the cutoff value being USD 55.55 billion.

Anginer et al. (2018) show that large banks pursue more of CSR measures than small banks, even though they are affected by higher systemic risk. The estimated results are showcased in Table A7 in the Appendix. We can note that higher changes in ESG Combined Score leads to a reduction in both systemic risk contribution and exposure, whereas for small banks better sustainable standards have a no effect on their systemic behavior.

Next, we perform the analysis independently for banks located in advanced and emerging countries, as defined by the International Monetary Fund. Finger et al. (2018) argue that in companies from developed countries the social and environmental concerns are adequately addressed through well-established mechanisms and procedures. In the same vein, firms operating in emerging markets face a variety of challenges related, *inter alia*, to countries' governance practices or legal systems that may affect the ESG dimensions through issues related to workforce rights, suspect environmental practices, lax information disclosure practices, etc. (Bahadori et al., 2021). From Table A8 in the Appendix we conclude that ESG performance contributes to a reduction of systemic risk exposure for banks situated in advanced markets. However, for those that have their headquarters in emerging markets the findings show an amplification of systemic risk contribution through interconnectedness.

Finally, we construct two dummy variables denoting high and low ESG Combined Scores based on Refinitiv thresholds. Banks with ESG Combined Scores above 75 are deemed as high performers (i.e., excellent relative ESG performance and high degree of transparency in reporting material ESG data publicly), whereas those with score below or equal to 25 are categorised as low performers (i.e., poor relative ESG performance and insufficient degree of transparency in reporting material ESG data publicly). The findings are displayed in Table A9 in the Appendix. We note that only banks with high ESG Combined Scores benefit from their sustainable practices, resulting in a reduction of both systemic risk contribution and exposure.

4. Conclusion

This paper investigates how changes in the Environmental, Social and Governance attributes, as well as the ESG Combined Score, influence banks' systemic risk contribution. Using a dynamic panel model for a sample of 367 publicly listed banks situated in 47 countries over the period 2007-2020, we document a beneficial impact of the ESG Combined Score and Governance pillar on its contribution to system-wide distress. Our findings can be explained by the stakeholder theory and theoretical models on the relationship between social performance and expected returns in which enhanced investments in corporate social responsibility mitigates bank specific risks. However, only better corporate governance represents a tool in reducing bank interconnectedness and maintaining financial stability. Moreover, we find the same relationship with banks' exposure to systemic risk. The results are robust to alternative measures of systemic risk, both contribution and exposure, as well as when estimating a static model. In addition, we disentangle the impact separately for large and small banks and find that the effect of the greater increase in ESG Combined Score matters only for large banks. Our findings point to a more pronounced and beneficial effect of sustainability on systemic distress for banks situated in developed countries and for those with better ESG Combined Scores.

In terms of policy recommendations, we stress the importance of integrating banks' ESG disclosure into regulatory authorities' supervisory mechanisms as non-financial information, that seek to reduce and mitigate banks' systemic behaviour, with the ultimate goal to maintain financial stability.

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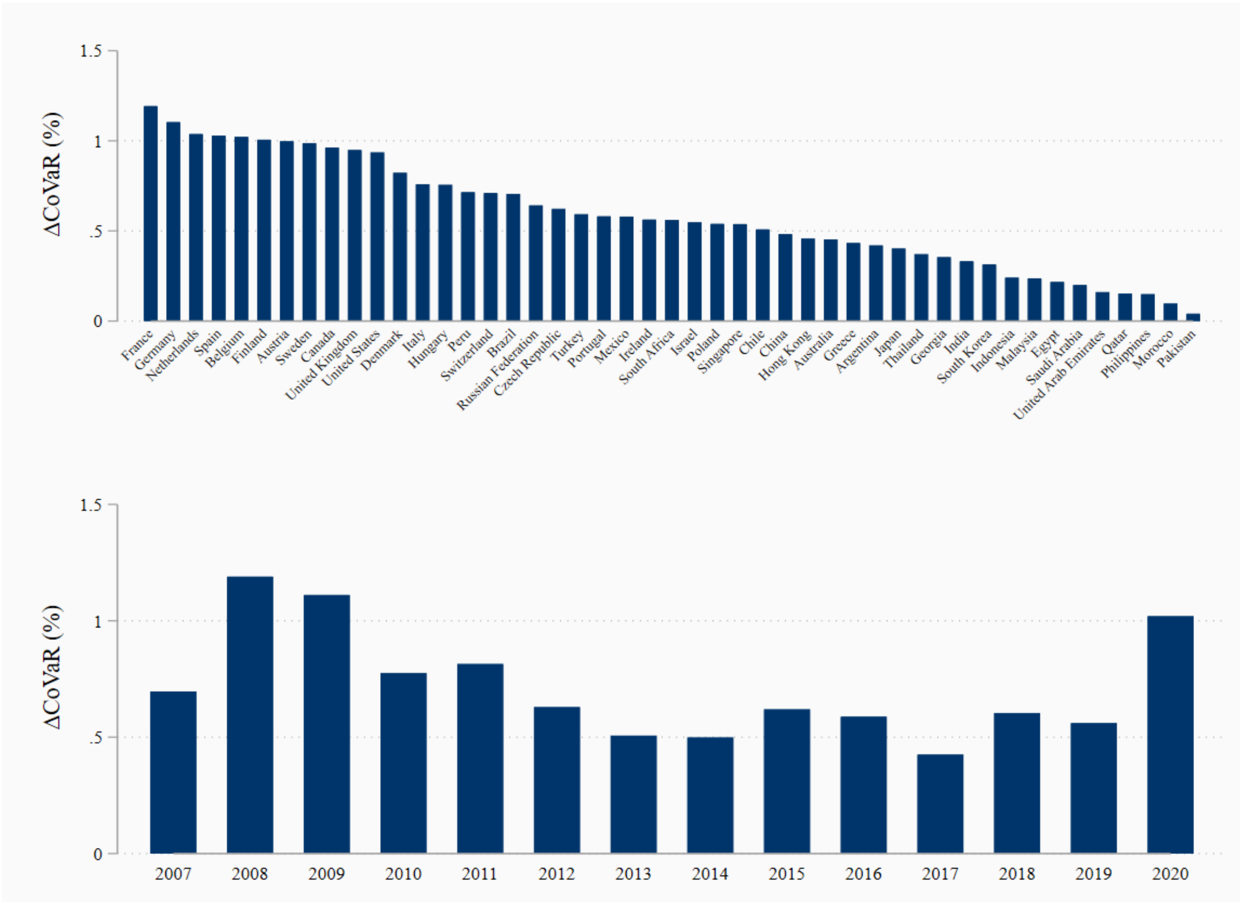

Figure 1. Average ΔCoVaR by country and by year.

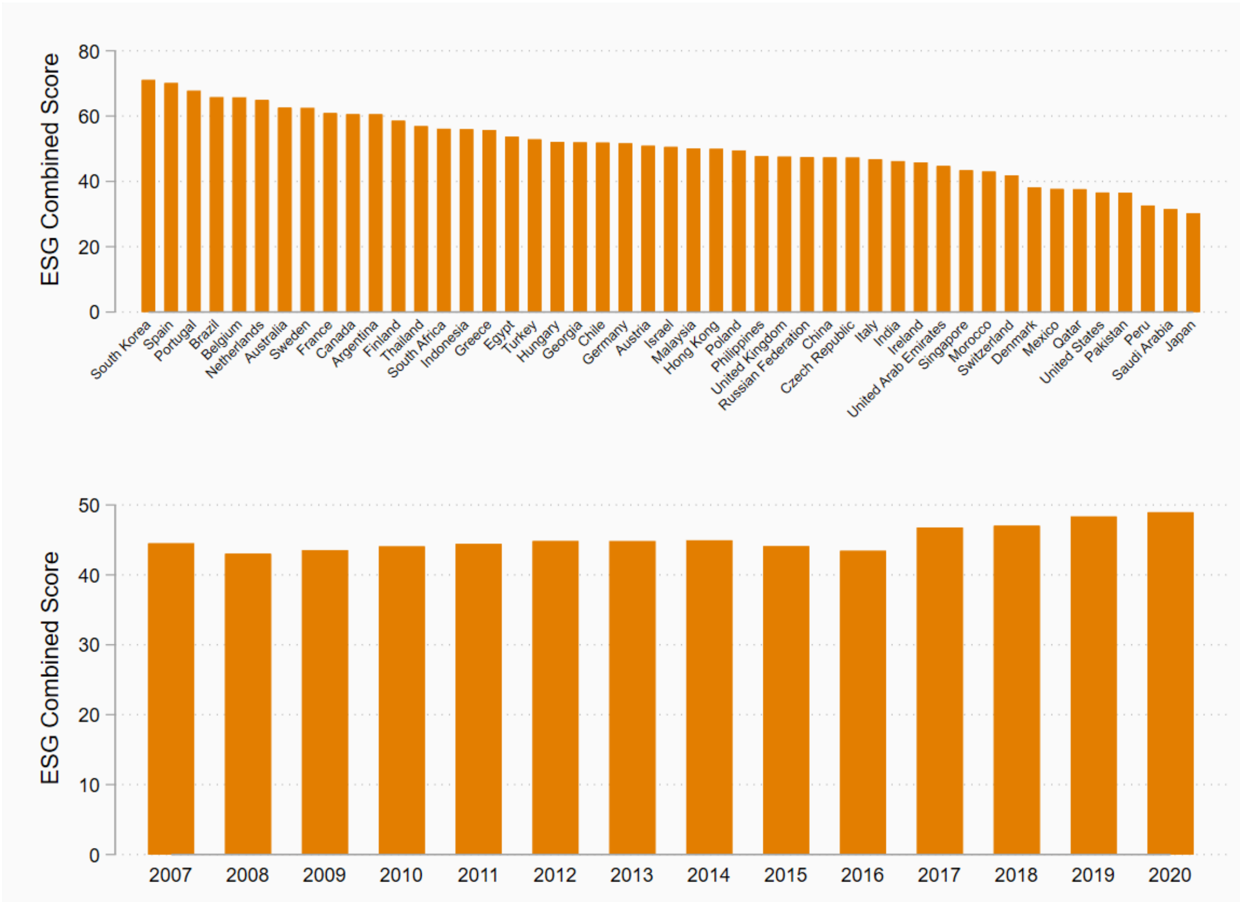

Figure 2. Average ESG Combined Score by country and by year.

Table 1. Baseline model results.

Dependent: ΔCoVaR	(1)	(2)	(3)	(4)
ΔESG Combined Score (t-1)	-0.0007*			
	(0.0004)			
ΔEnvironmental (t-1)		-0.0000		
		(0.0004)		
ΔSocial (t-1)			0.0007	
			(0.0005)	
ΔGovernance (t-1)				-0.0005*
				(0.0003)
Size (t-1)	0.0664***	0.0647***	0.0635***	0.0651***
	(0.0225)	(0.0225)	(0.0226)	(0.0225)
Capitalization (t-1)	-0.0051*	-0.0053*	-0.0054*	-0.0054*
	(0.0029)	(0.0029)	(0.0029)	(0.0029)
Profitability (t-1)	0.0002	0.0002	0.0002	0.0002
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Lending Activities (t-1)	0.0011	0.0011	0.0011	0.0012
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Credit Risk (t-1)	0.0032	0.0032	0.0033	0.0032
	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Funding Structure (t-1)	-0.0004	-0.0005	-0.0005	-0.0004
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Income Diversification (t-1)	-0.0019***	-0.0019***	-0.0019***	-0.0019***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Bank Concentration (t-1)	-0.0006	-0.0006	-0.0006	-0.0006
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Real GDP Growth (t-1)	0.0061***	0.0058**	0.0057**	0.0059**
	(0.0023)	(0.0023)	(0.0023)	(0.0023)
Inflation (t-1)	0.0021	0.0019	0.0019	0.0020
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Governance Index (t-1)	-0.2331***	-0.2324***	-0.2300***	-0.2325***
	(0.0556)	(0.0557)	(0.0557)	(0.0556)
ΔCoVaR (t-1)	0.7271***	0.7275***	0.7275***	0.7287***
	(0.0242)	(0.0241)	(0.0241)	(0.0242)
Observations	2784	2784	2784	2784
Banks	367	367	367	367
Countries	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results for the baseline model described in Eq. (5), using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variable is ΔCoVaR, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table 2. Robustness analysis – fixed effects estimator.

Dependent: ΔCoVaR	(1)	(2)	(3)	(4)
ΔESG Combined Score (t-1)	-0.0007**			
	(0.0003)			
ΔEnvironmental (t-1)		0.0000		
		(0.0003)		
ΔSocial (t-1)			0.0005	
			(0.0004)	
ΔGovernance (t-1)				-0.0004*
				(0.0002)
Size (t-1)	0.0961***	0.0946***	0.0940***	0.0944***
	(0.0262)	(0.0262)	(0.0261)	(0.0262)
Capitalization (t-1)	-0.0030	-0.0032	-0.0032	-0.0032
	(0.0052)	(0.0051)	(0.0051)	(0.0051)
Profitability (t-1)	-0.0014*	-0.0015*	-0.0015*	-0.0015*
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Lending Activities (t-1)	0.0005	0.0005	0.0005	0.0005
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Credit Risk (t-1)	0.0060**	0.0060**	0.0060**	0.0060**
	(0.0025)	(0.0025)	(0.0025)	(0.0025)
Funding Structure (t-1)	-0.0015	-0.0015	-0.0015	-0.0015
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Income Diversification (t-1)	-0.0014*	-0.0013*	-0.0013*	-0.0013*
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Bank Concentration (t-1)	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Real GDP Growth (t-1)	0.0041**	0.0038**	0.0038**	0.0039**
	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Inflation (t-1)	0.0010	0.0009	0.0008	0.0009
	(0.0016)	(0.0016)	(0.0016)	(0.0016)
Governance Index (t-1)	-0.1904***	-0.1893***	-0.1872***	-0.1892***
	(0.0623)	(0.0624)	(0.0623)	(0.0623)
Constant	-0.8714	-0.8361	-0.8257	-0.8337
	(0.6702)	(0.6688)	(0.6664)	(0.6682)
Observations	2785	2785	2785	2785
Banks	367	367	367	367
Countries	47	47	47	47
Adjusted R-squared	0.6999	0.6995	0.6996	0.6997
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results for the fixed effects estimator. The dependent variable is ΔCoVaR, defined in Table A1 from the Appendix. Robust standard errors clustered at the bank level in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table 3. Robustness analysis - NSRISK.

Dependent: NSRISK	(1)	(2)	(3)	(4)
ΔESG Combined Score (t-1)	-0.0029*			
	(0.0016)			
ΔEnvironmental (t-1)		-0.0016		
		(0.0017)		
ΔSocial (t-1)			-0.0039*	
			(0.0021)	
ΔGovernance (t-1)				-0.0007
				(0.0013)
Size (t-1)	0.2273**	0.2226**	0.2267**	0.2210**
	(0.0979)	(0.0975)	(0.0977)	(0.0975)
Capitalization (t-1)	-0.0254*	-0.0262*	-0.0251*	-0.0262*
	(0.0136)	(0.0136)	(0.0137)	(0.0136)
Profitability (t-1)	-0.0015	-0.0015	-0.0015	-0.0016
	(0.0023)	(0.0023)	(0.0023)	(0.0023)
Lending Activities (t-1)	0.0018	0.0019	0.0019	0.0019
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
Credit Risk (t-1)	-0.0297***	-0.0299***	-0.0301***	-0.0297***
	(0.0095)	(0.0095)	(0.0095)	(0.0095)
Funding Structure (t-1)	0.0029	0.0028	0.0029	0.0028
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Income Diversification (t-1)	0.0072***	0.0073***	0.0072***	0.0074***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Bank Concentration (t-1)	-0.0030	-0.0030	-0.0030	-0.0030
	(0.0021)	(0.0021)	(0.0021)	(0.0021)
Real GDP Growth (t-1)	-0.0292***	-0.0305***	-0.0297***	-0.0301***
	(0.0100)	(0.0100)	(0.0100)	(0.0101)
Inflation (t-1)	-0.0063	-0.0066	-0.0065	-0.0067
	(0.0067)	(0.0067)	(0.0067)	(0.0067)
Governance Index (t-1)	-0.1623	-0.1542	-0.1750	-0.1597
	(0.2076)	(0.2082)	(0.2073)	(0.2074)
NSRISK (t-1)	0.6924***	0.6926***	0.6931***	0.6934***
	(0.0210)	(0.0210)	(0.0210)	(0.0209)
Observations	2770	2770	2770	2770
Banks	367	367	367	367
Countries	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variable is NSRISK, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table 4. Robustness analysis – Systemic Factor.

Dependent: Systemic Factor	(1)	(2)	(3)	(4)
ΔESG Combined Score (t-1)	-0.0016**			
	(0.0008)			
ΔEnvironmental (t-1)		-0.0002		
		(0.0008)		
ΔSocial (t-1)			0.0012	
			(0.0010)	
ΔGovernance (t-1)				-0.0012*
				(0.0006)
Size (t-1)	0.1390***	0.1353***	0.1328***	0.1359***
	(0.0500)	(0.0498)	(0.0499)	(0.0496)
Capitalization (t-1)	-0.0119*	-0.0122*	-0.0125*	-0.0125*
	(0.0070)	(0.0069)	(0.0070)	(0.0069)
Profitability (t-1)	0.0004	0.0003	0.0003	0.0004
	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Lending Activities (t-1)	0.0026	0.0026	0.0026	0.0027
	(0.0017)	(0.0017)	(0.0017)	(0.0017)
Credit Risk (t-1)	0.0053	0.0053	0.0055	0.0051
	(0.0047)	(0.0047)	(0.0047)	(0.0047)
Funding Structure (t-1)	-0.0012	-0.0012	-0.0012	-0.0011
	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Income Diversification (t-1)	-0.0039***	-0.0038***	-0.0037***	-0.0038***
	(0.0012)	(0.0012)	(0.0012)	(0.0012)
Bank Concentration (t-1)	-0.0015	-0.0015	-0.0015	-0.0015
	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Real GDP Growth (t-1)	0.0110**	0.0104**	0.0102**	0.0106**
	(0.0049)	(0.0050)	(0.0050)	(0.0050)
Inflation (t-1)	0.0036	0.0034	0.0033	0.0035
	(0.0034)	(0.0033)	(0.0033)	(0.0034)
Governance Index (t-1)	-0.4870***	-0.4846***	-0.4802***	-0.4857***
	(0.1079)	(0.1080)	(0.1079)	(0.1077)
Systemic Factor (t-1)	0.7134***	0.7138***	0.7137***	0.7149***
	(0.0224)	(0.0224)	(0.0225)	(0.0224)
Observations	2770	2770	2770	2770
Banks	367	367	367	367
Countries	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variable is Systemic Factor, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table 5. Robustness analysis – Exposure-ΔCoVaR.

Dependent: eΔCoVaR	(1)	(2)	(3)	(4)
ΔESG Combined Score (t-1)	-0.0020**			
	(0.0010)			
ΔEnvironmental (t-1)		0.0001		
		(0.0008)		
ΔSocial (t-1)			0.0014	
			(0.0009)	
ΔGovernance (t-1)				-0.0010
				(0.0006)
Size (t-1)	0.2111***	0.2066***	0.1466***	0.2071***
	(0.0472)	(0.0473)	(0.0416)	(0.0471)
Capitalization (t-1)	0.0002	-0.0001	-0.0018	-0.0004
	(0.0057)	(0.0058)	(0.0051)	(0.0058)
Profitability (t-1)	0.0027**	0.0026**	0.0031***	0.0027**
	(0.0012)	(0.0012)	(0.0011)	(0.0012)
Lending Activities (t-1)	0.0023	0.0023	0.0016	0.0023
	(0.0016)	(0.0016)	(0.0014)	(0.0016)
Credit Risk (t-1)	-0.0134***	-0.0134***	-0.0130***	-0.0135***
	(0.0044)	(0.0043)	(0.0037)	(0.0044)
Funding Structure (t-1)	-0.0010	-0.0010	-0.0000	-0.0010
	(0.0012)	(0.0012)	(0.0011)	(0.0012)
Income Diversification (t-1)	-0.0017	-0.0015	-0.0016	-0.0016
	(0.0015)	(0.0015)	(0.0014)	(0.0015)
Bank Concentration (t-1)	-0.0014*	-0.0014*	-0.0016**	-0.0014*
	(0.0009)	(0.0009)	(0.0008)	(0.0008)
Real GDP Growth (t-1)	0.0110**	0.0103**	0.0122***	0.0105**
	(0.0046)	(0.0045)	(0.0042)	(0.0045)
Inflation (t-1)	0.0054	0.0050	0.0029	0.0052
	(0.0042)	(0.0042)	(0.0039)	(0.0042)
Governance Index (t-1)	-0.3522***	-0.3514***	-0.4125***	-0.3507***
	(0.1182)	(0.1182)	(0.1044)	(0.1182)
eΔCoVaR (t-1)	0.6603***	0.6613***	0.5391***	0.6614***
	(0.0222)	(0.0223)	(0.0238)	(0.0224)
Observations	2784	2784	2784	2784
Banks	367	367	367	367
Countries	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variable is Exposure-ΔCoVaR, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table 6. Additional robustness checks.

	(1)	(2)	(3)
Dependent: ΔCoVaR	HLM	Level	Crisis
ΔESG Combined Score (t-1)	-0.0006*		-0.0008**
	(0.0004)		(0.0004)
ESG Combined Score (t-1)		-0.0006*	
		(0.0003)	
Crisis			0.0416*
			(0.0217)
Size (t-1)	0.0731***	0.0665***	0.0798***
	(0.0062)	(0.0160)	(0.0239)
Capitalization (t-1)	-0.0014	-0.0045**	-0.0072**
	(0.0020)	(0.0022)	(0.0029)
Profitability (t-1)	-0.0015***	0.0006	0.0002
	(0.0005)	(0.0006)	(0.0008)
Lending Activities (t-1)	-0.0001	0.0015*	0.0016**
	(0.0005)	(0.0008)	(0.0008)
Credit Risk (t-1)	0.0045***	0.0028	0.0025
	(0.0014)	(0.0018)	(0.0022)
Funding Structure (t-1)	-0.0012**	-0.0011	-0.0005
	(0.0005)	(0.0007)	(0.0008)
Income Diversification (t-1)	-0.0009**	-0.0019***	-0.0022***
	(0.0005)	(0.0006)	(0.0007)
Bank Concentration (t-1)	0.0002	-0.0005	-0.0005
	(0.0004)	(0.0004)	(0.0004)
Real GDP Growth (t-1)	0.0023	0.0051**	0.0093***
	(0.0021)	(0.0021)	(0.0028)
Inflation (t-1)	0.0018	0.0007	0.0054***
	(0.0016)	(0.0015)	(0.0017)
Governance Index (t-1)	-0.0480	-0.2106***	-0.3383***
	(0.0332)	(0.0414)	(0.0602)
Constant	-0.5886***		
	(0.1866)		
ΔCoVaR (t-1)		0.7138***	0.7475***
		(0.0249)	(0.0237)
Country-level variance	-1.3172***		
	(0.1395)		
Bank-level variance	-2.1325***		
	(0.0574)		
Residual variance	-1.9135***		
	(0.0147)		
Observations	2785	3113	2549
Bannks	367	367	340
Countries	47	47	42
LR test	2828.0358***		
Bank FE	No	Yes	Yes
Year FE	Yes	Yes	Yes

Note: This table reports the results using the Hierarchical Linear Modeling (HLM) technique (Model (1)) and the bias-corrected least squares dummy variable (LSDVC) (Model (2) and (3)). The dependent variable is ΔCoVaR, defined in Table A1 from the Appendix. The HML model is estimated using the maximum likelihood estimation. The LR test compares the estimated model with the standard OLS regression, and the null hypothesis is that there are no significant differences between the two models. Standard errors for HLM and bootstrap standard errors based on 50 replications for LSDVC in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Appendix

Table A1. Description of variables.

Variable name	Definition	Source
Dependent variables (bank-level)		
Delta-CoVaR (ΔCoVaR) (%)	Bank *i*'s contribution to systemic risk as defined by Adrian and Brunnermeier (2016). ΔCoVaR is measured as the difference of the Value at Risk (VaR) of the financial system's log-return conditional on the tail event of a particular bank (5% worst outcomes) and the VaR of the financial system's log-return conditional on the median state of the bank (50% outcomes). ΔCoVaR is estimated using the Quantile Regression method for an empirical specification where the financial system's log-return is regressed on each banks' log-return and on a set of state variables that captures the exposure of financial institutions to common factors. The common factors are: (i) the daily return of MSCI World index; (ii) the volatility index (VIX); (iii) the daily real estate sector return (MSCI World Real Estate) in excess of the financial sector return (MSCI World Financials); (iv) the change in the three-month T-bill rate; (v) the spread between three-month repo rate and three-month T-bill rate; (vi) the spread of change in 10-year bond yield and three-month T-bill rate; and (vii) the change in the spread of Moody's Baa corporate bond yield and 10-year bond yield. System is defined as the MSCI World Financials index. The indicator is expressed as a positive number, higher values being associated with greater systemic importance	Own calculation; Data from Thomson Reuters Eikon and Federal Reserve Board's H.15
Normalized SRISK (NSRISK)	SRISK per unit of market capitalization. SRISK is defined as the loss of the bank i conditional by the financial system being in distress (5% worst outcomes) given by $SRISK_t^i = k \times Liabilities_t^i - (1-k) \times Equity_t^i \times (1 - LRMES_t^i)$, where k is set at 8% and denotes regulatory capital ratio, $Liabilities_t^i$ is the book value of total liabilities, $Equity_t^i$ is the market capitalization of the bank, and $LRMES_t^i$ is the long-run marginal expected shortfall computed as $1 - \exp(\log(1-d) \times beta)$, where d is the six-month crisis threshold for the market decline set at 40% and *beta* is the bank's beta coefficient. SRISK is determined using the GJR-GARCH method with two steps Quasi Maximum Likelihood (QML) estimation as in Acharya et al. (2012) and Brownlees and Engle (2017). SRISK is expressed in USD. System is defined by the MSCI World Financials index. Higher values are associated with greater systemic importance	Own calculation; Data from Thomson Reuters Eikon and Worldscope
Systemic Factor	Bank *i*'s systemic risk contribution computed as principal-component factor using factor analysis based on ΔCoVaR and NSRISK, where NSRISK is normalized SRISK based on bank *i*'s market capitalization, as in Berger et al. (2020). Higher values denote enhanced systemic risk contribution	
Exposure-ΔCoVaR (eΔCoVaR) (%)	Bank *i*'s exposure to systemic risk as defined by Adrian and Brunnermeier (2016). ΔCoVaR is measured as the difference of the Value at Risk (VaR) of the bank *i* log-return conditional on the tail event of the financial system (5% worst outcomes) and the VaR of bank *i* log-return conditional on the median state of the financial system (50% outcomes). Exposure-ΔCoVaR is estimated using the Quantile Regression method for an empirical specification where the log-return of bank *i* is regressed on financial systems's log-return and on a set of state variables that captures the exposure of financial institutions to common factors. The common factors are: (i) the daily return of MSCI World index; (ii) the volatility index (VIX); (iii) the daily real estate sector return (MSCI World Real Estate) in excess of the financial sector return (MSCI World Financials); (iv) the change in the three-month T-bill rate; (v) the spread between three-month repo rate and three-month T-bill rate; (vi) the spread of change in 10-year bond yield and three-month T-bill rate; and (vii) the change in the spread	Own calculation; Data from Thomson Reuters Eikon and Federal Reserve Board's H.15

	of Moody's Baa corporate bond yield and 10-year bond yield. System is defined as the MSCI World Financials index. The indicator is expressed as a positive number, higher values being associated with greater systemic exposure	
Independent variables (bank-level)		
ΔESG Combined Score	Yearly change in ESG Combined Score. ESG Combined Score is computed as the weighted average of Environmental, Social and Governance Pillars, discounted based on negative media stories (i.e., ESG controversies). The score takes values from 0 to 100, higher values being associated with improved ESG performance	Thomson Reuters Eikon
ΔEnvironmental	Yearly change in Environmental score. Environmental score is computed as the weighted average of the following components: emissions, innovation and resources. The score takes values from 0 to 100, higher values being associated with improved Environmental performance	Thomson Reuters Eikon
ΔSocial	Yearly change in Social score. Social score is computed as the weighted average of the following components: community, human rights, product responsibility and workforce. The index takes values from 0 to 100, higher values being associated with improved Social performance	Thomson Reuters Eikon
ΔGovernance	Yearly change in Governance score. Governance score is computed as the weighted average of the following components: CSR strategy, management and shareholders. The score takes values from 0 to 100, higher values being associated with improved Governance performance	Thomson Reuters Eikon
Size	Natural logarithm of Total Assets expressed in USD	Worldscope
Capitalization (%)	Common Equity/Total Assets	Worldscope
Profitability (%)	Proxied by Return on Equity (ROE), being computed as Net Income/Common Equity	Worldscope
Lending Activities (%)	Total Loans/Total Assets	Worldscope
Credit Risk (%)	Non-performing Loans/Total Loans	Worldscope
Funding Structure (%)	Total Deposits/Total Liabilities	Worldscope
Income Diversification (%)	Non-interest Income/Revenue	Worldscope
Banking system/macroeconomic variables		
Bank Concentration (%)	Assets of three largest banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax, discontinued operations and other assets	Global Financial Development Database – World Bank
Real GDP Growth (%)	Annual percentage growth rate of Gross Domestic Product based on constant local currency. Aggregates are based on constant 2010 U.S. dollars	World Development Indicators – World Bank
Inflation (%)	Annual growth rate of the GDP implicit deflator. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency	World Development Indicators – World Bank
Governance Index	Equally-weighted average of the six Worldwide Governance Indicators: (i) control of corruption; (ii) government effectiveness; (iii) political stability; (iv) regulatory quality; (v) rule of law; and (vi) voice and accountability. Higher values are associated with better governance	Worldwide Governance Indicators – World Bank
Other variables		
Crisis	Dummy variable which takes the value of 1 for crisis periods, and 0 otherwise. Crisis periods are defined as 2008-2009 period for all non-European countries, and accordind to European Systemic Risk Board methodology for European countries	Global Financial Development Database – World Bank

Table A2. Summary statistics: whole sample.

Variables	Unit	Mean	St. dev.	p25	Median	p75	Min	Max	Obs.
ΔCoVaR	%	0.6938	0.4257	0.3927	0.6029	0.8531	-0.0245	2.6333	2784
NSRISK		1.3479	9.4354	-0.4349	-0.1275	0.6769	-1.4112	179.8547	2770
Systemic Factor		-1.8445	0.9259	-2.4791	-2.0530	-1.5234	-3.3748	3.2277	2770
Exposure-ΔCoVaR	%	1.4100	1.0166	0.6707	1.1428	1.7841	0.0590	5.8633	2784
ΔESG Combined Score		1.3531	8.3820	-2.5400	1.1600	5.5400	-39.3800	37.0900	2753
ΔEnvironment		1.3591	10.6537	-1.1200	0.0000	2.5200	-63.1800	70.0700	2753
ΔSocial		2.1230	6.8571	-1.8200	0.8200	4.8400	-32.9800	39.6300	2753
ΔGovernance		0.7401	11.9692	-5.6400	0.4200	7.1700	-54.8900	53.7900	2753
Size		25.3075	1.5981	24.1609	25.1307	26.4733	21.8807	29.1758	2784
Capitalization	%	8.8794	3.6692	6.2100	8.4724	11.1277	-5.0962	30.3854	2784
Profitability	%	7.0603	87.5087	6.2400	9.9200	13.9000	-4300.0000	117.3000	2777
Lending Activities	%	64.1342	13.8786	56.3313	66.1656	73.6214	1.9881	97.9006	2778
Credit Risk	%	3.2126	4.9271	0.9084	1.8049	3.5456	0.0000	85.1587	2763
Funding Structure	%	72.5484	18.8701	61.4552	76.7346	87.7516	0.0000	99.9549	2784
Income Diversification	%	29.0561	14.1247	18.9160	27.6237	37.9969	-18.6610	99.4497	2783
Bank Concentration	%	54.0911	20.6355	35.2228	47.6098	68.7109	22.7555	100.0000	2774
Real GDP Growth	%	1.5910	3.5355	0.4675	2.1612	3.0355	-11.1488	25.1762	2784
Inflation	%	2.2231	4.0368	0.9142	1.7567	2.4010	-25.1298	50.9215	2784
Governance Index		0.8621	0.6809	0.4492	1.0948	1.3329	-0.9972	1.8729	2784

Note: This table exhibits the descriptive statistics of variables used in the empirical analysis. Data for ESG factors and control variables are based on ΔCoVaR as the main dependent variable. To deal with outliers, we winsorize all variables between 1st and 99th percentiles.

Table A3. Summary statistics: large banks.

Variables	Unit	Mean	St. dev.	p25	Median	p75	Min	Max	Obs.
ΔCoVaR	%	0.7034	0.4420	0.3981	0.5902	0.8568	0.0810	2.5513	1846
NSRISK		2.1247	11.5062	-0.2937	0.1555	1.2051	-0.9836	179.855	1833
Systemic Factor		-1.8068	0.9771	-2.4586	-2.0732	-1.5044	-3.1598	3.2277	1833
Exposure-ΔCoVaR	%	1.4250	1.0548	0.6505	1.1278	1.8248	0.0849	5.6945	1846
ΔESG Combined Score		1.1759	9.0790	-2.7400	1.0500	5.6800	-39.3800	37.0900	1829
ΔEnvironment		1.4503	10.8475	-1.5100	0.1400	2.8100	-56.6100	70.0700	1829
ΔSocial		2.1281	6.5831	-1.5600	0.8500	4.8300	-32.9800	39.6300	1829
ΔGovernance		0.5416	11.7610	-5.7100	0.1300	6.6500	-54.8900	50.0000	1829
Size		26.1466	1.2364	25.1390	25.8195	27.0422	23.5494	29.1758	1846
Capitalization	%	7.7190	3.0322	5.6560	7.2243	9.5390	-5.0962	25.6623	1846
Profitability	%	5.6784	107.2889	5.4700	10.0550	14.5500	-4300.0000	82.9500	1840
Lending Activities	%	62.1287	13.0340	54.6952	64.1966	71.8380	2.7264	92.7364	1844
Credit Risk	%	3.5910	5.1646	1.2119	2.1446	3.9295	0.0000	63.1339	1834
Funding Structure	%	67.1841	19.1559	56.1032	69.2683	82.6646	9.3218	98.6724	1846
Income Diversification	%	31.5372	13.3956	21.4602	30.4689	40.2238	-18.6610	79.6301	1845
Bank Concentration	%	57.7788	20.8638	37.4081	57.3908	74.3334	22.7555	100.0000	1836
Real GDP Growth	%	1.8099	3.7041	0.4757	2.0372	3.3290	-11.1488	25.1762	1846
Inflation	%	2.1608	3.1101	0.7421	1.6863	2.8499	-25.1298	24.4601	1846
Governance Index		0.8206	0.7271	0.2076	1.1803	1.3681	-0.7593	1.8729	1846

Note: This table exhibits the descriptive statistics of variables used in the empirical analysis. Data for ESG factors and control variables are based on ΔCoVaR as the main dependent variable. To deal with outliers, we winsorize all variables between 1st and 99th percentiles.

Table A4. Summary statistics: small banks.

Variables	Unit	Mean	St. dev.	p25	Median	p75	Min	Max	Obs.
ΔCoVaR	%	0.6751	0.3912	0.3781	0.6234	0.8477	-0.0245	2.6333	938
NSRISK		-0.1717	0.8656	-0.5272	-0.3961	-0.1641	-1.4112	13.509	937
Systemic Factor		-1.9182	0.8119	-2.5304	-2.0208	-1.5689	-3.3748	2.138	937
Exposure-ΔCoVaR	%	1.3806	0.9366	0.7218	1.1717	1.6806	0.0590	5.8633	938
ΔESG Combined Score		1.7038	6.7854	-2.1800	1.4400	5.3200	-27.6400	31.4200	924
ΔEnvironment		1.1785	10.2625	-0.0100	0.0000	1.9200	-63.1800	67.1600	924
ΔSocial		2.1130	7.3730	-2.3600	0.6650	4.8800	-32.6800	39.1200	924
ΔGovernance		1.1329	12.3681	-5.4800	1.0300	7.9950	-47.2300	53.7900	924
Size		23.6561	0.6766	23.1632	23.7201	24.2128	21.8807	24.9615	938
Capitalization	%	11.1631	3.7430	8.8132	10.8033	13.0921	1.8110	30.3854	938
Profitability	%	9.7739	9.1878	7.2600	9.7300	12.5500	-67.6500	117.3000	937
Lending Activities	%	68.0936	14.6315	61.9835	70.4084	76.8297	1.9881	97.9006	934
Credit Risk	%	2.4656	4.3273	0.6692	1.1900	2.5072	0.0121	85.1587	929
Funding Structure	%	83.1055	12.9150	75.8263	87.0456	92.7631	0.0000	99.9549	938
Income Diversification	%	24.1758	14.2565	14.2747	22.2215	31.0855	-1.4386	99.4497	938
Bank Concentration	%	46.8729	18.1362	34.4259	35.2654	57.8706	24.9335	100.0000	938
Real GDP Growth	%	1.1601	3.1353	0.4103	2.1612	2.9965	-10.8229	8.2563	938
Inflation	%	2.3459	5.4158	1.1675	1.7852	2.4010	-15.1004	50.9215	938
Governance Index		0.9437	0.5708	0.8284	1.0917	1.2537	-0.9972	1.8379	938

Note: This table exhibits the descriptive statistics of variables used in the empirical analysis. Data for ESG factors and control variables are based on ΔCoVaR as the main dependent variable. To deal with outliers, we winsorize all variables between 1st and 99th percentiles.

Table A5. Averages by country.

Country	Total Assets (bil. USD)	ΔCoVaR (%)	ESG Combined Score	ΔESG Combined Score
Argentina	12.00	0.45	67.11	3.94
Australia	443.00	0.46	63.64	-0.88
Austria	201.00	1.00	51.84	3.20
Belgium	359.00	1.03	65.34	-0.45
Brazil	319.00	0.69	66.51	-0.10
Canada	416.00	0.95	61.53	0.14
Chile	52.90	0.50	54.83	1.42
China	1770.00	0.46	50.02	1.95
Czech Republic	33.80	0.64	48.46	0.45
Denmark	241.00	0.83	39.60	1.50
Egypt	20.50	0.22	55.06	0.94
Finland	693.00	1.07	61.14	2.26
France	2050.00	1.22	60.85	-0.63
Georgia	6.14	0.38	53.55	4.28
Germany	1100.00	1.11	51.69	0.07
Greece	104.00	0.43	58.34	2.59
Hong Kong	177.00	0.46	51.27	2.73
Hungary	50.70	0.71	53.59	1.07
India	127.00	0.33	47.65	1.55
Indonesia	64.60	0.23	58.79	2.52
Ireland	161.00	0.57	46.77	0.96
Israel	90.80	0.53	53.99	3.15
Italy	324.00	0.78	48.31	1.88
Japan	389.00	0.40	30.72	0.56
Malaysia	79.90	0.22	52.39	2.78
Mexico	42.60	0.58	40.69	3.27
Morocco	45.80	0.10	46.48	2.79
Netherlands	866.00	1.04	65.11	-0.44
Pakistan	16.10	0.04	37.92	2.22
Peru	48.70	0.68	32.63	2.82
Philippines	41.30	0.15	49.99	3.46
Poland	37.90	0.52	51.81	2.75
Portugal	103.00	0.58	68.43	1.33
Qatar	79.70	0.15	41.07	2.16
Russian Federation	349.00	0.60	51.53	2.79
Saudi Arabia	63.80	0.20	34.27	1.62
Singapore	270.00	0.56	46.42	3.00
South Africa	95.40	0.54	57.41	0.06
South Korea	270.00	0.31	73.87	1.61
Spain	608.00	1.05	71.09	-0.73
Sweden	314.00	1.02	63.40	0.29
Switzerland	180.00	0.75	44.85	1.28
Thailand	69.40	0.35	60.55	3.64
Turkey	88.60	0.56	55.09	2.35
United Arab Emirates	124.00	0.17	46.54	0.39
United Kingdom	1450.00	0.96	47.67	0.52
United States	185.00	0.98	38.53	1.42

Note: This table exhibits the average values of Total Assets, ΔCoVaR, ESG Combined Score and ΔESG Combined Score by country for 2007-2020 period.

Table A6. Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) ΔESG Combined Score	1.0000														
(2) ΔEnvironmental	0.2273*	1.0000													
(3) ΔSocial	0.4720*	0.1875*	1.0000												
(4) ΔGovernance	0.5395*	0.0582*	0.0799*	1.0000											
(5) Size	-0.0775*	-0.0161	-0.0245	-0.0393*	1.0000										
(6) Capitalization	0.0549*	0.0036	0.0320*	0.0111	-0.5674*	1.0000									
(7) Profitabiliy	0.0386*	0.0104	0.0143	-0.0205	-0.0017	0.1134*	1.0000								
(8) Lending Activities	0.0633*	0.0403*	0.0401*	0.0245	-0.4145*	0.1345*	-0.0349*	1.0000							
(9) Credit Risk	0.0089	-0.0180	0.0080	0.0009	0.0577*	-0.0933*	-0.1318*	0.0979*	1.0000						
(10) Funding Structure	0.0559*	-0.0052	0.0308	0.0088	-0.5244*	0.3556*	0.0520*	0.3180*	-0.2161*	1.0000					
(11) Income diversification	-0.0332*	-0.0325*	-0.0114	-0.0178	0.2720*	-0.1575*	0.0431*	-0.5131*	0.0105	-0.2378*	1.0000				
(12) Bank Concentration	-0.0158	0.0210	-0.0048	0.0033	0.2672*	-0.3268*	-0.0165	0.0134	0.1350*	-0.4271*	0.0378*	1.0000			
(13) Real GDP Growth	0.0786*	-0.0266	0.0907*	0.0421*	0.0588*	0.0873*	0.1186*	0.0288	-0.1168*	0.0839*	-0.0916*	-0.0267	1.0000		
(14) Inflation	0.0483*	0.1077*	0.0423*	0.0223	-0.0795*	0.1745*	0.0423*	-0.0670*	0.0244	-0.0529*	-0.1177*	0.0405*	0.1001*	1.0000	
(15) Governance Index	-0.0609*	-0.0408*	-0.0743*	-0.0042	0.0100	-0.2320*	-0.0072	-0.0316*	-0.1862*	-0.0156	0.1587*	0.0008	-0.2137*	-0.3552*	1.0000

Note: * shows statistical significance at the maximum level of significance of 10%.

Table A7. Large vs. small banks.

	Large banks		Small banks	
	(1)	(2)	(1)	(2)
Variables	ΔCoVaR	eΔCoVaR	ΔCoVaR	eΔCoVaR
ΔESG Combined Score (t-1)	-0.0008***	-0.0024***	0.0001	-0.0003
	(0.0003)	(0.0006)	(0.0009)	(0.0019)
Size (t-1)	0.0217	0.0898*	0.1476***	0.3177***
	(0.0265)	(0.0521)	(0.0302)	(0.0668)
Capitalization (t-1)	-0.0096***	-0.0136**	0.0024	0.0165
	(0.0035)	(0.0069)	(0.0048)	(0.0103)
Profitability (t-1)	-0.0000	0.0036**	0.0015	-0.0001
	(0.0008)	(0.0015)	(0.0014)	(0.0028)
Lending Activities (t-1)	0.0011	0.0024	0.0019	0.0031
	(0.0009)	(0.0018)	(0.0014)	(0.0030)
Credit Risk (t-1)	0.0035*	-0.0172***	0.0021	0.0013
	(0.0020)	(0.0039)	(0.0043)	(0.0088)
Funding Structure (t-1)	-0.0005	-0.0012	-0.0002	-0.0009
	(0.0008)	(0.0016)	(0.0011)	(0.0023)
Income Diversification (t-1)	-0.0022***	-0.0024*	-0.0005	0.0015
	(0.0007)	(0.0014)	(0.0015)	(0.0033)
Bank Concentration (t-1)	-0.0003	-0.0004	-0.0017	-0.0035
	(0.0004)	(0.0008)	(0.0011)	(0.0024)
Real GDP Growth (t-1)	0.0055**	0.0072	0.0047	0.0212*
	(0.0026)	(0.0051)	(0.0054)	(0.0110)
Inflation (t-1)	0.0025	0.0060*	0.0016	0.0032
	(0.0018)	(0.0035)	(0.0031)	(0.0065)
Governance Index (t-1)	-0.1019	-0.0413	-0.6667***	-1.4170***
	(0.0633)	(0.1272)	(0.1159)	(0.2588)
ΔCoVaR (t-1)	0.7145***		0.8170***	
	(0.0310)		(0.0345)	
eΔCoVaR (t-1)		0.6745***		0.6390***
		(0.0317)		(0.0361)
Observations	1846	1846	937	937
Banks	184	184	183	183
Countries	42	42	30	30
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variables is are ΔCoVaR and Exposure-ΔCoVaR, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table A8. Advanced vs. emerging markets.

	Advanced markets		Emerging markets	
	(1)	(2)	(1)	(2)
Variables	ΔCoVaR	eΔCoVaR	ΔCoVaR	eΔCoVaR
ΔESG Combined Score (t-1)	-0.0007	-0.0024***	0.0005**	0.0007
	(0.0005)	(0.0009)	(0.0002)	(0.0008)
Size (t-1)	0.0854***	0.2882***	-0.0186*	-0.0745*
	(0.0312)	(0.0623)	(0.0099)	(0.0389)
Capitalization (t-1)	-0.0054	0.0044	-0.0039**	-0.0050
	(0.0046)	(0.0091)	(0.0015)	(0.0059)
Profitability (t-1)	0.0000	0.0020	0.0011**	0.0027
	(0.0008)	(0.0015)	(0.0005)	(0.0017)
Lending Activities (t-1)	0.0009	0.0018	0.0004	0.0035**
	(0.0010)	(0.0019)	(0.0004)	(0.0016)
Credit Risk (t-1)	0.0065***	-0.0134***	0.0003	0.0086**
	(0.0021)	(0.0042)	(0.0012)	(0.0043)
Funding Structure (t-1)	-0.0004	0.0004	0.0003	0.0005
	(0.0010)	(0.0019)	(0.0004)	(0.0016)
Income Diversification (t-1)	-0.0027***	-0.0030*	0.0019***	0.0042**
	(0.0008)	(0.0016)	(0.0005)	(0.0017)
Bank Concentration (t-1)	0.0006	-0.0011	-0.0003*	-0.0011*
	(0.0006)	(0.0012)	(0.0002)	(0.0007)
Real GDP Growth (t-1)	-0.0023	0.0063	0.0023**	0.0095***
	(0.0039)	(0.0079)	(0.0010)	(0.0037)
Inflation (t-1)	0.0115**	0.0066	0.0007	-0.0001
	(0.0046)	(0.0091)	(0.0006)	(0.0024)
Governance Index (t-1)	-0.1945***	0.1750	-0.0232	-0.2371***
	(0.0728)	(0.1455)	(0.0211)	(0.0839)
ΔCoVaR (t-1)	0.7644***		1.6402***	
	(0.0274)		(0.0004)	
eΔCoVaR (t-1)		0.6635***		0.6564***
		(0.0274)		(0.0332)
Observations	1954	1954	830	830
Banks	259	259	108	108
Countries	24	24	23	23
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variables is are ΔCoVaR and Exposure-ΔCoVaR, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

Table A9. High vs. low ESG Combined Score.

	(1)	(2)	(3)	(4)
Variables	ΔCoVaR	eΔCoVaR	ΔCoVaR	eΔCoVaR
High ESG Combined Score (t-1)	-0.0434***	-0.0842**		
	(0.0165)	(0.0351)		
Small ESG Combined Score (t-1)			-0.0111	-0.0328
			(0.0115)	(0.0243)
Size (t-1)	0.0739***	0.2194***	0.0708***	0.2133***
	(0.0163)	(0.0337)	(0.0164)	(0.0340)
Capitalization (t-1)	-0.0031	0.0077	-0.0031	0.0081*
	(0.0023)	(0.0048)	(0.0023)	(0.0048)
Profitability (t-1)	0.0001	0.0021*	0.0000	0.0019
	(0.0006)	(0.0012)	(0.0006)	(0.0013)
Lending Activities (t-1)	0.0013	0.0024	0.0014	0.0025
	(0.0009)	(0.0018)	(0.0009)	(0.0018)
Credit Risk (t-1)	0.0014	-0.0148***	0.0014	-0.0148***
	(0.0018)	(0.0038)	(0.0018)	(0.0038)
Funding Structure (t-1)	-0.0005	0.0001	-0.0005	0.0001
	(0.0008)	(0.0016)	(0.0008)	(0.0016)
Income Diversification (t-1)	-0.0022***	-0.0032**	-0.0022***	-0.0032**
	(0.0006)	(0.0013)	(0.0006)	(0.0013)
Bank Concentration (t-1)	-0.0007*	-0.0020**	-0.0007*	-0.0020**
	(0.0004)	(0.0009)	(0.0004)	(0.0009)
Real GDP Growth (t-1)	0.0057***	0.0136***	0.0059***	0.0139***
	(0.0022)	(0.0046)	(0.0022)	(0.0047)
Inflation (t-1)	0.0016	0.0038	0.0017	0.0039
	(0.0015)	(0.0033)	(0.0015)	(0.0033)
Governance Index (t-1)	-0.2546***	-0.5151***	-0.2607***	-0.5195***
	(0.0426)	(0.0902)	(0.0428)	(0.0906)
ΔCoVaR (t-1)	0.7936***		0.7902***	
	(0.0222)		(0.0223)	
eΔCoVaR (t-1)		0.8300***		0.8312***
		(0.0219)		(0.0219)
Observations	3113	3113	3113	3113
Banks	367	367	367	367
Countries	47	47	47	47
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results using the bias-corrected least squares dummy variable (LSDVC) technique developed by Kiviet (1995) and adopted to unbalanced panels by Bruno (2005), being initialized by the Blundell-Bond estimator. The dependent variables are ΔCoVaR and Exposure-ΔCoVaR, defined in Table A1 from the Appendix. Bootstrap standard errors based on 50 replications in parentheses. ***, **, and * show statistical significance at the 1%, 5% and 10% level, respectively.

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c/o University of Geneva, Bd. Du Pont d'Arve 42, CH-1211 Geneva 4
T +41 22 379 84 71, rps@sfi.ch, www.sfi.ch