

ESG performance and equity returns of S&P 500 firms under the 2026 Strait of Hormuz crisis

Yingzheng Liu¹

¹ aSSIST University

Fei Huang

huangfei@assist.ac.kr

¹ aSSIST University

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Abstract

The 2026 Strait of Hormuz crisis, beginning with hostilities on 28 February 2026 and the subsequent Iranian restriction of the waterway, created a major geopolitical and energy-supply shock. Approximately one-fifth of global seaborne oil trade normally transits the strait. We examine whether pre-crisis environmental, social and governance (ESG) performance is associated with milder equity losses. Using an S&P 500 sample of 225 firms with available ESG risk scores and daily equity returns, we compute market-model and Fama–French five-factor cumulative abnormal returns (CARs) around key event dates. Higher pre-event ESG performance (lower ESG risk scores) is associated with less negative CARs at the onset of the crisis. The association remains significant after controlling for firm size and industry fixed effects (coefficient -0.00153 , $p = 0.002$) and is robust to the five-factor model. Pillar tests show that the Environmental score, rather than Social or Governance scores, accounts for the association, consistent with an energy-security mechanism. Results are strongest in multi-day windows around the initial restriction. These findings indicate that ESG attributes are associated with milder equity-market losses under acute energy-security shocks. By linking pre-crisis ESG characteristics—especially environmental performance—to equity-market outcomes under a critical oil-chokepoint disruption, the study informs sustainable development debates on energy security (SDG 7), climate-related and environmental risk management (SDG 13), and responsible corporate and investment practices (SDG 12).

Introduction

Geopolitical disruptions to critical energy chokepoints generate abrupt increases in uncertainty and input-cost volatility. The Strait of Hormuz crisis that began in late February 2026 provides a clear natural experiment. Following coordinated military action against Iran on 28 February 2026, Iranian forces effectively restricted commercial traffic through the strait. Daily vessel transits fell sharply from pre-crisis levels of roughly 100–130 ships. A temporary memorandum of understanding signed on 17 June 2026 produced a partial recovery that reversed after renewed attacks on 7–8 July 2026.

Prior research shows that firms with stronger ESG profiles often exhibit lower downside risk and milder equity-price reactions during periods of elevated uncertainty, including the early COVID-19 period and the Russia–Ukraine energy shock^{1–5,8–15}. Proposed mechanisms include lower exposure to fossil-fuel price risk, stronger stakeholder relationships that preserve demand and financing access, and higher-quality governance that supports rapid operational adjustment. Whether these patterns hold under a direct maritime chokepoint closure remains an open empirical question.

Figure 1. *Conceptual framework. Independent variable: pre-crisis ESG risk score (and Environmental pillar under H1b). Dependent variable: equity resilience measured by CAR. Covariates: firm size, valuation ratios and industry fixed effects. Energy versus non-energy is an exploratory diagnostic only (small energy cell). H1 predicts a negative coefficient on ESG risk scores at the Hormuz onset; H1b predicts that the Environmental pillar drives the association.*

We test these predictions using an S&P 500 sample, multiple event windows, market-model and Fama–French five-factor abnormal returns, and cross-sectional regressions controlling for firm size and industry. We further examine industry heterogeneity and changes in realised volatility.

Despite these advances, evidence on ESG resilience under a maritime chokepoint closure remains limited. Prior studies focus primarily on land-based conflicts or broad pandemic shocks. By examining equity-market reactions around the onset, temporary relief and re-escalation of the Hormuz restriction, and by employing both market-model and Fama–French five-factor abnormal returns, the present study contributes to the literature on ESG as a correlate of equity-market resilience under geopolitical energy shocks.

A parallel literature analyses the impact of geopolitical risk on equity markets. News-based geopolitical risk indices have been shown to predict higher crash risk and elevated volatility¹⁶, especially when threats rather than realised acts intensify. Event studies of wars and energy-supply disruptions consistently find negative average abnormal returns^{17–19}, with substantial cross-sectional heterogeneity by industry exposure, geographic footprint and financial strength. The 2026 Strait of Hormuz crisis combines both geopolitical hostility and a direct constraint on a critical oil-shipping chokepoint, providing a setting in which ESG-related resilience can be tested under acute energy-security stress.

Theoretical mechanisms proposed in the literature include reduced exposure to transition and physical climate risks, improved access to capital and customer loyalty, and higher managerial quality that facilitates rapid operational adjustment. Asset-pricing models that incorporate ESG preferences further imply^{20,21} that investors may accept lower expected returns for high-ESG assets in normal times, yet demand a smaller risk premium when downside states materialise. Empirical support for these channels is mixed across regions and asset classes, with stronger resilience effects often observed in North American equity and credit markets than in some emerging economies.

Recent work has extended this line of inquiry to geopolitical and energy-related shocks. Studies of the Russia–Ukraine conflict show that firms with higher industry-adjusted ESG scores tended to record less negative cumulative abnormal returns^{8–11,14} in the days surrounding the invasion. Environmental performance, particularly efficient resource use and lower carbon intensity, has been identified as an important channel^{9,11} of resilience when energy supply is threatened. Governance quality has also been linked to more favourable market reactions under elevated uncertainty, while social scores appear to matter more in contexts where stakeholder coordination is critical.

A substantial literature examines whether environmental, social and governance (ESG) attributes help firms withstand negative shocks. Meta-analytic and large-sample evidence suggests that, on average, stronger ESG performance is associated with lower downside risk^{1,3} and more resilient equity returns during periods of market stress. During the global financial crisis, firms with higher social capital experienced milder stock-price declines², consistent with the view that stakeholder relationships act as a form of insurance. Similar patterns have been documented around the onset of the COVID-19 pandemic,

where high-ESG firms displayed relatively stronger abnormal returns and lower volatility in multiple markets^{4,5,12}.

The economic stakes of the Hormuz corridor are large. Pre-crisis estimates attribute roughly one-fifth of global seaborne oil trade and a material share of liquefied natural gas movements to the strait. A sustained restriction therefore transmits quickly into energy prices, input costs for energy-intensive industries, and risk premia for firms whose supply chains or demand depend on stable hydrocarbon flows. Equity markets provide a high-frequency window on how investors reassess these exposures. If ESG attributes proxy for operational flexibility, stakeholder insurance or lower fossil-fuel intensity, then firms with stronger pre-crisis ESG scores should experience milder abnormal returns when the restriction materialises—the prediction formalised in H1 and H2.

From a sustainable development perspective, maritime energy-chokepoint shocks sit at the intersection of energy security, climate and environmental risk, and responsible corporate conduct. United Nations Sustainable Development Goal (SDG) 7 emphasises affordable, reliable and sustainable energy; SDG 13 calls for urgent action on climate and related environmental risks; and SDG 12 promotes sustainable consumption and production patterns, including more responsible corporate disclosure and investment. Empirically documenting whether firms with stronger pre-crisis environmental and ESG profiles experience milder equity losses when oil logistics are disrupted therefore contributes evidence relevant to sustainability-oriented risk management, capital allocation and the design of transparency regimes that support the SDGs under geopolitical stress.

Literature review

Building on this literature, we formulate one primary hypothesis and one mechanism-oriented prediction. H1: Firms with stronger pre-crisis ESG performance (lower ESG risk scores) experience less negative cumulative abnormal returns around the onset of the Strait of Hormuz crisis. H1b (mechanism): Among ESG pillars, the Environmental score is expected to drive the association under an energy-chokepoint shock, whereas Social and Governance scores need not. Industry heterogeneity between energy and non-energy firms is examined only as an exploratory extension, because the energy subsample is too small for a formal moderation test. We test these predictions using market-model and Fama–French five-factor event-study returns, pillar decompositions, and cross-sectional regressions that control for firm size, valuation ratios and industry.

Despite this progress, three gaps remain. First, evidence on ESG resilience under a direct maritime energy-chokepoint closure is scarce; most geopolitical studies focus on land-based conflict or sanctions. Second, few papers jointly report market-model and Fama–French five-factor CARs together with industry splits that separate energy producers from the rest of the economy. Third, the relative roles of environmental, social and governance pillars under energy-security stress are still incompletely mapped. The present study addresses these gaps by examining equity reactions around the onset,

temporary relief and re-escalation of the Hormuz restriction, testing H1 and H2 with both single-factor and five-factor abnormal returns, and documenting heterogeneity by sector.

Event-study methodology remains the workhorse for identifying short-window market reactions to discrete shocks. Classic applications to macroeconomic announcements, mergers and geopolitical events establish the design principles used here⁶: a pre-event estimation window for the market model or multi-factor model, cumulative abnormal returns over symmetric windows around the event, and cross-sectional regressions of CARs on firm characteristics. Applications to the Russia–Ukraine invasion document negative average CARs with substantial heterogeneity by energy exposure, geographic footprint and sustainability ratings. The 2026 Strait of Hormuz crisis differs in combining geopolitical hostility with a physical constraint on a chokepoint that carries a large share of seaborne oil trade, thereby tightening the link between energy-supply risk and firm-level equity outcomes.

Asset-pricing theory provides further structure. Models in which a subset of investors has ESG preferences imply that high-ESG assets may command higher valuations in normal times and exhibit lower required returns when downside states materialise, because constrained or values-driven capital is less likely to exit under stress. Empirical tests of these predictions during COVID-19 and subsequent geopolitical episodes yield mixed results across regions and asset classes: resilience effects are often stronger in North American equities and credit markets than in some emerging economies, and they can fade as the acute phase of a crisis passes. Rating disagreement across ESG providers adds noise to cross-sectional tests^{22,23} and motivates the use of industry-adjusted scores and multi-factor benchmarks.

Mechanisms proposed for ESG resilience under external disruptions include employee motivation and customer loyalty. Studies of natural disasters find that high-CSR manufacturing plants suffer smaller declines in operating performance^{27–29}, with post-disaster productivity and sales stability mediating the effect. In the context of energy-price and rationing shocks linked to the Russia–Ukraine conflict, the environmental pillar—especially efficient resource use and lower carbon intensity—has been identified as the primary driver of milder equity reactions. Governance quality has been shown to matter more when institutional trust is strained, while social performance appears more salient where stakeholder coordination is critical for continuity of operations.

A complementary strand of research examines how firms adjust ESG behaviour when geopolitical and political risks rise. Evidence from multi-country panels indicates that lagged increases in geopolitical risk are associated with subsequent improvements in firm-level ESG scores, consistent with an insurance-like motive: managers invest in sustainability attributes to buffer future shocks. The environmental pillar sometimes responds differently from social and governance dimensions, reflecting short-term trade-offs between compliance costs and longer-term resilience. Related work on multinational enterprises shows that foreign subsidiaries intensify ESG efforts when media-reported tension between home and host countries increases, particularly where historical conflict raises the expected value of legitimacy-building strategies.

Energy-market structure also conditions the expected cross-section of returns. Firms in upstream oil and gas, refining, shipping and energy-intensive manufacturing differ in their exposure to a Hormuz disruption. High-ESG energy firms may still face direct volume or price risk, whereas high-ESG non-energy firms may benefit more from lower fossil dependence, diversified supply chains or stronger non-market relationships. This reasoning underpins H2. Official maritime and price data from 2026 confirm that the restriction was material for flows and sentiment; the equity-market test asks whether pre-existing ESG differences predicted the distribution of losses once the shock arrived.

At the same time, the literature cautions against treating ESG as a universal hedge. Resilience effects can be region-specific, stronger in some institutional environments than others, and sometimes confined to particular asset classes such as equities or credit default swaps. ESG rating divergence across providers implies that the measured association depends on the chosen score, the degree of industry adjustment, and the timing of the pre-crisis snapshot. Our use of a single pre-crisis cross-section of Sustainalytics-style risk scores therefore trades breadth of history for transparency and reproducibility, while the multi-window and multi-factor design helps assess whether the main pattern is an artefact of a particular return model.

Comparative evidence from Eastern European markets during the Russia–Ukraine war further supports a moderating role for ESG. Panel estimates for firms in Poland, Russia and Ukraine indicate that geopolitical risk depresses profitability, yet the adverse effect is attenuated for firms with stronger ESG scores. Similar moderating patterns appear in broader international samples when stock-price crash risk is the outcome: geopolitical threats raise crash risk, but high-ESG issuers—particularly those strong on environmental and social dimensions—are less affected. These findings reinforce the interpretation of ESG as a form of organisational slack or stakeholder insurance that becomes valuable when external uncertainty spikes.

Finally, climate-financial risk research has emphasised physical and transition risks^{24,25} at the asset and system level, including amplification through leverage and cross-border exposure of production networks. While those studies focus on climate extremes and long-horizon scenarios rather than discrete geopolitical chokepoint events, they share a methodological commitment to linking firm or security characteristics to differential loss under stress. The present paper applies a related logic to a geopolitical energy shock: ESG characteristics measured before the event are used to organise the cross-section of short-window equity losses, thereby connecting sustainability metrics to resilience under a sudden constraint on global oil logistics.

Methods

Variables

Dependent variable. The primary dependent variable is the cumulative abnormal return (CAR) over the event window $[-3, +3]$ trading days around each event date, computed from the market model.

Alternative windows ($[-1, +1]$, $[-5, +5]$, $[-10, +10]$) and Fama–French five-factor CARs for the onset event are used for robustness. A supplementary outcome is the change in realised volatility between a pre-event window and the event window.

Independent variable. The key independent variable is the pre-crisis ESG risk score (total score). Lower values indicate better ESG performance (Sustainalytics-style convention). Pillar scores for Environmental (E), Social (S) and Governance (G) are available for descriptive analysis; the main tests use the aggregate score to maximise coverage and comparability.

Control variables. Firm size is measured as the natural logarithm of market capitalisation. Additional firm-level controls, when available in the merged file, include the price-to-earnings ratio and dividend yield as proxies for valuation and payout policy, and the inverse of price-to-book as a rough book-to-market proxy. Industry affiliation is controlled via sector fixed effects (GICS-style sectors) or, in exploratory splits, a binary Energy-sector indicator. These controls help separate the ESG association from size, valuation and broad industry exposure; they do not fully capture firm-level oil-price beta or physical shipping exposure, which would require additional data.

Moderating variable. Industry exposure is the principal moderator. H2 predicts that the ESG–CAR association is stronger for non-energy firms. Moderation is examined through (i) an interaction term between the ESG risk score and an Energy-sector dummy and (ii) separate regressions for energy and non-energy subsamples.

Empirical specification for hypothesis tests. H1 is tested by regressing onset $CAR[-3, +3]$ on the ESG risk score, with and without size and industry fixed effects: $CAR_i = \alpha + \beta_1 ESG_i + \gamma' Controls_i + FE + \varepsilon_i$. A negative and significant β_1 supports H1 (higher risk score $\rightarrow$ more negative CAR). H2 is tested via the interaction $ESG \times Energy$ and via subsample splits. A weaker or insignificant ESG slope in the energy subsample, together with a significant negative slope among non-energy firms, supports H2.

Sample and data

The sample comprises S&P 500 firms (large US-listed companies) for which both a pre-crisis ESG risk score and daily equity returns are available. ESG data are taken from a publicly shared S&P 500 ESG file that reports Sustainalytics-style total and pillar risk scores with a snapshot date of 3 March 2021—well before the 2026 Hormuz events—together with sector and selected financial fields. This timing limits anticipatory ESG upgrading in response to the crisis itself, but it also means scores are lagged and may not reflect 2024–2025 sustainability changes; we treat the snapshot as a predetermined cross-sectional characteristic. Daily adjusted close prices for 2025–2026 are obtained from Yahoo Finance. After ticker alignment and requiring sufficient estimation-window observations, 225 firms enter the ESG–return panel and 222 firms have non-missing onset CARs. Coverage is uneven across sectors (for example, Information Technology is relatively well represented; Energy contributes only eight firms). Results should not be extrapolated to small-capitalisation or non-US firms without further evidence.

Event dates and windows

Primary events are 28 February 2026 (onset of major restriction) and 7–8 July 2026 (renewed attacks). A secondary event is 17 June 2026 (memorandum of understanding). Windows of $[-1, +1]$, $[-3, +3]$, $[-5, +5]$ and $[-10, +10]$ trading days are examined.

Empirical models

Abnormal returns are estimated with the market model (S&P 500 ETF as the market proxy) over a pre-event estimation window of approximately 120 trading days ending 15 days before each event.

Cumulative abnormal returns (CARs) are formed for each firm and window. Parallel calculations are performed with the Fama–French five-factor model⁷ for the onset event. Cross-sectional regressions take the form $CAR_i = \alpha + \beta_1 ESG_i + \gamma'X_i + FE + \varepsilon_i$, where ESG_i is the pre-crisis total ESG risk score, X_i contains the logarithm of market capitalisation, and FE denotes industry fixed effects.

Heteroskedasticity-robust standard errors are reported. Portfolio differences between high- and low-ESG groups (split at the median ESG risk score) are also examined.

Robustness is assessed in three ways. First, alternative event windows ($[-1,+1]$, $[-5,+5]$, $[-10,+10]$) are reported to check sensitivity to window length. Second, CARs are recomputed under the Fama–French five-factor model for the onset event, for which official daily factors are available through June 2026. Third, the cross-sectional regression is estimated with and without industry fixed effects and with a binary energy-sector indicator to isolate industry heterogeneity. Standard errors are heteroskedasticity-robust. Firms with insufficient estimation-window observations are excluded from CAR calculations, yielding an analysis sample of 222 firms for the main onset specifications.

Implementation details for replication. Daily returns are computed from adjusted close prices. The market model uses the S&P 500 ETF (SPY) as the market proxy. The estimation window is approximately 120 trading days ending 15 trading days before each event; firms with fewer than 60 valid estimation-window observations are dropped. High- and low-ESG groups are defined by the sample median of the total ESG risk score (below or equal to the median = high ESG / low risk). Industry classifications follow the sector field in the ESG dataset (GICS-style). Heteroskedasticity-robust (HC1) standard errors are used in all cross-sectional regressions. Fama–French five-factor data are taken from Kenneth French's library and are available through 30 June 2026, so five-factor CARs are reported for the onset event only.

Additional firm-level controls. When price-to-earnings and dividend yield are included alongside log market capitalisation, the total ESG coefficient remains negative and significant (-0.00105 , $p = 0.012$, $N = 222$). With sector fixed effects and the same valuation controls, the coefficient is -0.00148 ($p = 0.003$, $R^2 = 0.16$). The Environmental pillar coefficient remains -0.00205 ($p = 0.005$) under the same PE and dividend controls. Thus the main association is not an artefact of omitting standard valuation covariates. Direct energy-exposure measures (refining throughput, reported Middle East sales, or equity oil betas) are not in the current file and remain a priority for future robustness.

Abnormal returns are estimated firm by firm with a market model (SPY as market proxy) over an estimation window of about 120 trading days ending 15 days before each event; firms with fewer than 60 estimation observations are excluded. Cumulative abnormal returns are formed over $[-1, +1]$, $[-3, +3]$, $[-5, +5]$ and $[-10, +10]$. Identification is strengthened by (i) predetermined ESG scores dated March 2021, (ii) a narrow event window that limits confounding macro news, (iii) industry fixed effects and valuation controls that absorb persistent firm heterogeneity, and (iv) a five-factor adjustment for the onset event. We further compare multi-day windows with the one-day window and the wide $[-10, +10]$ window: an association that is concentrated around the onset and weak in short or very wide windows is harder to attribute to a permanent return difference unrelated to the crisis. Daily average abnormal returns (CAAR paths) by ESG group are a natural graphical extension for the replication package; the present draft emphasises cumulative windows and cross-sectional regressions for brevity and tabular clarity.

The empirical design relies on a sudden, common energy-security shock rather than on firm-initiated ESG changes. Key dates are: 28 February 2026 (onset of major restriction of the Strait of Hormuz), 17 June 2026 (temporary memorandum of understanding), and 7–8 July 2026 (renewed attacks and re-escalation). The primary test uses the onset date, when uncertainty about the feasibility and severity of a chokepoint closure was resolved most sharply. Later dates are used as secondary events to assess whether any ESG–return association persists or reappears when news arrives after portfolios have partially adjusted.

Identification and event timeline

Results

Descriptive patterns

Figure 2 shows the distribution of ESG total risk scores by sector. Energy and Utilities exhibit the highest average risk scores, while Real Estate and Consumer Discretionary show the lowest. Figure 3 presents the corresponding pillar-level means.

Event-study evidence

In the $[-3, +3]$ window around 28 February 2026, the average market-model CAR for the high-ESG portfolio is +0.53%, while the low-ESG portfolio records –1.38%. Parallel patterns hold for the $[-5, +5]$ window. These differences are consistent with H1. Differentials around the 17 June memorandum and the July re-escalation are smaller.

Cross-sectional regressions

Table 1 reports ordinary-least-squares regressions of CARs on the pre-crisis ESG risk score. Consistent with H1, the coefficient on ESG is negative and statistically significant in the main onset windows: higher ESG risk (worse performance) is associated with more negative abnormal returns. The baseline estimate for the $[-3, +3]$ window is -0.00113 ($p = 0.008$). Adding firm size leaves the coefficient almost unchanged (-0.00110 , $p = 0.009$). Including industry fixed effects strengthens the estimate to -0.00153 ($p = 0.002$). Results remain significant for the $[-5, +5]$ window but become insignificant for the very short $[-1, +1]$ window and for later events.

Table 1
Cross-sectional regressions of CARs on pre-crisis ESG risk score

Dependent var.	(1) $[-3,+3]$	(2) +Size	(3) + FE	(4) $[-5,+5]$	(5) $[-1,+1]$	(6) Re-esc.
ESG risk score	-0.00113^{***}	-0.00110^{***}	-0.00153^{***}	-0.00116^{**}	0.00014	-0.00003
	(0.00042)	(0.00042)	(0.00050)	(0.00054)	(0.00017)	(0.00029)
Log market cap	No	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	No	No	No
N	222	222	222	222	222	222
R ²	0.029	0.047	0.153	0.071	0.017	0.001
Notes: Heteroskedasticity-robust standard errors in parentheses. ESG risk score is the total score (lower = better). *** $p < 0.01$, ** $p < 0.05$.						

Industry heterogeneity and Fama–French results

Figure 6 and Table 3 show that the protective association is concentrated in the non-energy subsample (coefficient -0.00139 , $p = 0.001$), consistent with H2. The energy subsample is small ($N = 8$) and yields an insignificant coefficient. High-ESG firms exhibit higher average five-factor CARs ($+1.26\%$) than low-ESG firms (-0.57%) in the onset $[-3, +3]$ window (Table 2), further supporting H1 under the Fama–French five-factor benchmark. The cross-sectional regression of five-factor CARs on the ESG risk score yields a coefficient of -0.00111 ($p = 0.013$).

Table 2
Mean CARs by ESG group

Event window	High ESG	Low ESG	Difference
Onset $[-3,+3]$ (market model)	$+0.53\%$	-1.38%	1.91 pp
Onset $[-3,+3]$ (FF5)	$+1.26\%$	-0.57%	1.83 pp
Re-escalation $[-3,+3]$	-0.71%	-1.06%	0.35 pp

Table 3
Industry split (Onset CAR [-3,+3])

Subsample	ESG coef.	p-value	N
Energy	0.00123	0.571	8
Non-Energy	-0.00139***	0.001	214

Volatility results provide a supplementary check. Realised volatility rose around the onset for both ESG groups, but the change in volatility was not significantly related to the ESG risk score after controlling for size. The equity-return pattern therefore does not appear to be driven primarily by a differential volatility channel in this sample. Instead, the CAR evidence is more consistent with a mean-return or risk-premium channel: investors required a smaller discount—or applied a smaller adverse revision—to high-ESG firms when the energy-security shock materialised.

Taken together, the event-study and regression evidence indicates that the ESG–resilience association is concentrated at the initial onset of the crisis rather than at later policy or military inflection points. The memorandum of understanding in mid-June and the July re-escalation produced smaller and statistically weaker differentials. One interpretation is that the first restriction resolved a large portion of uncertainty about the feasibility and severity of a chokepoint closure, so subsequent news had lower marginal information content for the cross-section of ESG exposures. Another is that portfolio rebalancing and learning after February reduced the scope for further ESG-based differentiation. Distinguishing these interpretations would require higher-frequency ownership and order-flow data that lie beyond the present design.

H2. An interaction regression of onset CAR on ESG, Energy, $\text{ESG} \times \text{Energy}$ and size yields a negative main effect of ESG (-0.0014 , $p = 0.001$) and a positive interaction term (0.0027 , $p = 0.208$) that is not statistically significant at conventional levels, consistent with a weaker protective slope inside the energy sector. Split-sample estimates confirm the pattern: among non-energy firms ($N = 214$) the ESG coefficient is -0.00139 ($p = 0.001$); among energy firms ($N = 8$) it is 0.00123 ($p = 0.571$). The protective association is therefore concentrated outside energy, consistent with H2 in direction, but only suggestive given the small energy subsample ($N = 8$).

H1. In the onset window $[-3, +3]$, the mean market-model CAR is $+0.53\%$ for the high-ESG (low-risk) group and -1.38% for the low-ESG (high-risk) group. In the cross-section, the coefficient on the ESG risk score is -0.00110 ($p = 0.009$) with size controls and -0.00153 ($p = 0.002$) with size and industry fixed effects ($N = 222$). The same sign and significance obtain for the $[-5, +5]$ window and for Fama–French five-factor CARs (coefficient -0.00111 , $p = 0.013$). These results are consistent with H1: better pre-crisis ESG performance is associated with less negative abnormal returns at the onset of the crisis.

Economically, a one-standard-deviation higher ESG risk score is associated with approximately 0.95 percentage points lower onset CAR in the size-controlled specification (ESG SD ≈ 8.6), which is material relative to the cross-sectional dispersion of event returns (CAR SD $\approx 5.7\%$).

Environmental (E): coefficient = - 0.00202, p = 0.005, N = 222, R² = 0.059. Social (S): coefficient = - 0.00083, p = 0.296, N = 222, R² = 0.023. Governance (G): coefficient = - 0.00139, p = 0.362, N = 222, R² = 0.022. Total ESG: coefficient = - 0.00110, p = 0.009, N = 222, R² = 0.047.

Table 5. Pillar regressions of onset CAR[-3, + 3] on ESG pillar scores (HC1 standard errors; control: log market capitalisation).

ESG total: N = 225, mean = 21.53, SD = 8.63, p25 = 15, p50 = 18, p75 = 31. E pillar: mean = 5.86, SD = 5.80. S pillar: mean = 9.03, SD = 4.17. G pillar: mean = 6.66, SD = 2.17. Onset CAR[-3,+3]: N = 222, mean = - 0.37%, SD = 5.70%. Onset CAR[-1,+1]: mean = 0.36%, SD = 2.36%. Onset CAR[-5,+5]: mean = - 1.56%, SD = 7.65%.

Table 4. **Descriptive statistics (S&P 500 analysis sample). ESG scores are risk scores (lower = better). CARs are market-model cumulative abnormal returns around 28 February 2026.**

As a design check on window choice, the ESG coefficient in the wider onset window [-10, + 10] remains negative (- 0.00124) but is only marginally significant (p = 0.067). Short-window estimates for [-1, + 1] remain insignificant, as reported above. Formal placebo CARs restricted to pure pre-event days (e.g. [-10, - 2]) require a separate estimation pass and are recommended for the replication package; the decline in significance as the window moves away from the immediate onset is already consistent with an event-concentrated association rather than a permanent cross-sectional return difference.

Pillar-level regressions of onset CAR[-3, + 3] on each pillar score, controlling for log market capitalisation, show that the Environmental pillar accounts for most of the aggregate association (coefficient - 0.00202, p = 0.005, N = 222). The Social pillar coefficient is - 0.00083 (p = 0.30) and the Governance coefficient is - 0.00139 (p = 0.36). These patterns are consistent with an energy-security interpretation in which environmental intensity and resource efficiency are more closely tied to equity reactions under a chokepoint shock than social or governance scores alone. A one-standard-deviation higher total ESG risk score (about 8.6 points) is associated with approximately 0.95 percentage points lower onset CAR under the size-controlled specification.

Table 4 summarises the main variables. The mean ESG total risk score is 21.5 (SD 8.6); Environmental, Social and Governance pillar means are 5.9, 9.0 and 6.7, respectively. Mean onset CAR[-3, + 3] is - 0.37% (SD 5.7%). The correlation between the total ESG risk score and onset CAR is - 0.17; among pillars, the Environmental score shows the strongest raw correlation with CAR (- 0.23), while Social (- 0.04) and Governance (- 0.01) correlations are weak.

Descriptive statistics and pillar tests

Table 4 reports summary statistics for the analysis sample of S&P 500 firms with non-missing pre-crisis ESG risk scores and onset-event returns. The mean total ESG risk score is 21.53 (standard deviation 8.63), with a median of 18 and an interquartile range from 15 to 31. Among pillars, the Social score has the highest mean (9.03), followed by Governance (6.66) and Environmental (5.86). Market capitalisation

is highly skewed; regressions therefore use its natural logarithm. Mean market-model CAR in the onset window $[-3, +3]$ is -0.37% (SD 5.70%), indicating a modest average loss with substantial cross-sectional dispersion. Shorter and longer windows show mean CARs of $+0.36\%$ $[-1, +1]$ and -1.56% $[-5, +5]$, respectively.

Pairwise correlations align with the subsequent regression evidence. The total ESG risk score correlates with onset CAR $[-3, +3]$ at -0.17 . The Environmental pillar exhibits the strongest association (-0.23), whereas Social (-0.04) and Governance (-0.01) correlations are close to zero. Environmental and Social scores are moderately correlated with the total score (0.77 and 0.76), while Governance correlates more weakly (0.50). These patterns motivate pillar-level tests that separate environmental intensity from social and governance attributes under an energy-security shock.

Table 4
Descriptive statistics for the S&P 500 analysis sample.

Variable	N	Mean	SD	p25	p50	p75
ESG total risk score	225	21.53	8.63	15.00	18.00	31.00
Environmental (E)	225	5.86	5.80	1.00	4.00	10.00
Social (S)	225	9.03	4.17	6.00	8.00	11.00
Governance (G)	225	6.66	2.17	5.00	6.00	8.00
Market cap (USD bn)	225	93.93	237.79	15.80	32.67	74.86
CAR $[-1, +1]$ (%)	222	0.36	2.36	-0.72	0.60	1.59
CAR $[-3, +3]$ (%)	222	-0.37	5.70	-3.34	-0.50	1.85
CAR $[-5, +5]$ (%)	222	-1.56	7.65	-6.07	-1.20	1.94
Notes: ESG scores are risk scores (lower values indicate better performance). CARs are market-model cumulative abnormal returns around 28 February 2026. Market capitalisation is shown in USD billions for readability; regressions use $\ln(\text{market cap})$.						

Table 5 reports ordinary-least-squares regressions of onset CAR $[-3, +3]$ on each ESG pillar and on the total score, always controlling for log market capitalisation, with heteroskedasticity-robust (HC1) standard errors. The Environmental coefficient is -0.00202 ($p = 0.005$): firms with higher environmental risk scores experienced significantly more negative abnormal returns. Social and Governance coefficients are negative but statistically insignificant ($p = 0.30$ and $p = 0.36$). The total-score coefficient (-0.00110 , $p = 0.009$) therefore appears to be driven primarily by the environmental dimension. This decomposition is consistent with an energy-chokepoint interpretation, in which resource intensity and environmental exposure are more tightly linked to equity reactions than social or governance scores alone in this sample.

Table 5
Pillar and total-score regressions of onset CAR[−3, + 3].

Regressor	Coefficient	HC1 SE	p-value	N	R ²
Environmental (E)	−0.00202	0.00072	0.005	222	0.059
Social (S)	−0.00083	0.00080	0.296	222	0.023
Governance (G)	−0.00139	0.00152	0.362	222	0.022
Total ESG risk score	−0.00110	0.00042	0.009	222	0.047
Notes: Each row is a separate regression of market-model CAR[−3, + 3] on the listed score plus ln(market capitalisation). HC1 = heteroskedasticity-robust standard errors. Lower ESG scores indicate better performance; a negative coefficient means higher risk scores are associated with lower CARs.					

Economically, a one-standard-deviation increase in the total ESG risk score (approximately 8.6 points) is associated with about 0.95 percentage points lower onset CAR in the size-controlled specification. Relative to the cross-sectional standard deviation of CAR (5.7%), this corresponds to roughly one-sixth of a standard deviation—modest in absolute terms but non-negligible given the short event window and the breadth of the S&P 500 cross-section.

Window sensitivity provides a further design check. In the wider onset window [−10, + 10], the total ESG coefficient remains negative (− 0.00124) but is only marginally significant ($p = 0.067$). In the very short window [−1, + 1] the coefficient is indistinguishable from zero (see Table 1). The association is therefore concentrated in multi-day windows around the onset rather than in a one-day price jump or a long-horizon drift. A pure pre-event placebo window (for example [−10, − 2]) is a natural extension for the replication package; the decay of significance away from the immediate onset already points away from a permanent cross-sectional return difference unrelated to the crisis.

Hypothesis verification

H1 states that firms with stronger pre-crisis ESG performance (lower ESG risk scores) experience less negative cumulative abnormal returns around the onset of the Strait of Hormuz crisis. Three layers of evidence are consistent with this prediction.

First, portfolio sorts. Splitting the sample at the median ESG risk score yields a high-ESG (low-risk) group with mean onset CAR[−3, + 3] of + 0.53% and a low-ESG (high-risk) group with mean − 1.38% (difference 1.91 percentage points; $N = 118$ and 104 , respectively). Parallel gaps appear for Fama–French five-factor CARs (+ 1.26% versus − 0.57%).

Second, continuous regressions. Conditional on log market capitalisation, the ESG risk score enters with coefficient − 0.00110 ($p = 0.009$). Adding industry fixed effects strengthens the estimate to − 0.00153 ($p = 0.002$, $N = 222$, $R^2 = 0.153$). The five-factor CAR specification produces a coefficient of − 0.00111 ($p =$

0.013). Significance holds for $[-5, +5]$ but not for $[-1, +1]$ or for the later memorandum and re-escalation events (Table 1).

Third—and central to mechanism interpretation (H1b)—pillar decomposition (Table 5) shows that the Environmental score alone reproduces a significant negative association (-0.00202 , $p = 0.005$; -0.00205 with valuation controls, $p = 0.005$), whereas Social and Governance scores do not. This pattern is more informative than a generic high-ESG effect: under a chokepoint shock that threatens oil logistics, environmental intensity and resource exposure are the dimensions that line up with equity losses. Taken together, the portfolio, continuous and pillar evidence supports H1/H1b as association results for the onset window, without claiming that ESG is the sole causal driver of the cross-section of returns.

Industry heterogeneity is reported only as an exploratory diagnostic. Among non-energy firms ($N = 214$) the size-controlled ESG coefficient is -0.00139 ($p = 0.001$); among energy firms ($N = 8$) it is 0.00123 ($p = 0.571$). An interaction term $ESG \times Energy$ is positive but insignificant (0.0027 , $p = 0.208$). With only eight energy firms, these patterns cannot support a formal moderation claim and are not treated as a main result.

Summary of hypothesis tests. H1 is supported by portfolio differences, continuous regressions with size, valuation and industry controls, five-factor CARs, and—centrally—the environmental pillar (H1b). Social and governance pillars are insignificant, which matches an energy-security mechanism more closely than a generic “good firm” story. Energy versus non-energy splits are exploratory only. All tests report association; residual confounding by unobserved operational flexibility cannot be ruled out.

Discussion

The results are consistent with the view that ESG attributes are associated with patterns consistent with resilience when energy-supply routes are disrupted. Firms with stronger pre-crisis ESG performance experienced milder equity-market losses at the onset of the Strait of Hormuz crisis. The association is robust to firm size, industry fixed effects and the Fama–French five-factor adjustment, and is most pronounced in the immediate multi-day windows surrounding the initial restriction.

The findings have practical implications for risk management and for the design of sustainability metrics that capture operational resilience under geopolitical stress. Future work can incorporate higher-frequency shipping and oil-inventory data, examine real-side outcomes, expand the sample beyond large-capitalisation U.S. firms, and test whether the ESG–return association under stress persists once the physical disruption ends.

Several economic mechanisms can rationalise the observed association. First, firms with stronger environmental performance may face lower marginal costs when energy prices spike or shipping routes are disrupted, because they rely less on carbon-intensive inputs or have already invested in efficiency and alternative sourcing. Second, social capital—embodied in employee relations, customer loyalty and community ties—can stabilise demand and productivity when physical operations are stressed, as

suggested by evidence from natural disasters. Third, higher governance quality may facilitate faster managerial responses, more transparent communication with investors and better access to contingency financing. These channels are not mutually exclusive; the cross-sectional pattern that the ESG–CAR relation is stronger outside the energy sector is consistent with a relative-exposure interpretation: non-energy firms that score well on ESG may be less directly tied to the disrupted commodity flow and more able to substitute or absorb cost shocks.

From a policy perspective, the results speak to debates on mandatory sustainability disclosure and the design of stress tests. If equity markets systematically differentiate firms by pre-crisis ESG when energy chokepoints are threatened, then transparent, comparable ESG information may improve the allocation of capital under geopolitical stress. Conversely, if rating noise or greenwashing dilutes the signal, the measured ESG–return association under stress will understate the value of true operational sustainability. Supervisors and standard-setters concerned with systemic energy-security risk may therefore have an interest both in the quality of ESG metrics and in the real capabilities—efficiency, supply-chain flexibility, stakeholder relations—that those metrics imperfectly capture. In SDG terms, the results speak to SDG 7 (energy security and resilience of energy-related systems), SDG 13 (managing environmental and climate-linked transition risks when physical energy routes are constrained), and SDG 12 (responsible corporate sustainability information that capital markets can use under stress). Clearer, more comparable environmental disclosure may help investors and policymakers identify firms better positioned to absorb energy-supply shocks, thereby supporting more sustainable capital allocation.

Our results also relate to the broader debate on whether ESG captures risk management capacity or primarily reflects investor preferences. If the Hormuz premium were driven solely by values-based demand, one might expect a more uniform effect across industries and a stronger link to contemporaneous ESG flows. The concentration of the effect among non-energy firms, the robustness to industry fixed effects, and the consistency under a multi-factor return model are more readily aligned with a risk-exposure interpretation: pre-crisis ESG differences proxy, imperfectly, for differences in sensitivity to an energy-supply shock. That interpretation does not rule out preference effects; it suggests that, in this episode, the cross-section of abnormal returns is informative about resilience-related fundamentals as well as about capital allocation by ESG-conscious investors.

This study makes three main contributions. First, it extends the ESG–resilience literature from pandemic and land-based geopolitical shocks to a direct maritime energy-chokepoint crisis among large US-listed firms. Second, a pillar decomposition shows that the Environmental score, not Social or Governance scores, accounts for the equity association—providing mechanism-consistent evidence under an oil-shipping disruption. Third, the association remains after controls for firm size, valuation ratios (earnings yield-related and dividend measures) and industry fixed effects, and under a Fama–French five-factor benchmark, which raises the bar relative to an uncontrolled event-study contrast alone. Industry splits by energy versus non-energy are reported only as exploratory diagnostics given the small energy cell.

Several limitations should be acknowledged. ESG scores are measured with a lag relative to the 2026 events and are subject to well-documented rating disagreement and measurement error; we mitigate this by using the latest available pre-crisis observation, but residual noise remains. The energy subsample is small (eight firms), which limits statistical power for industry-specific inference and precludes strong claims about energy producers. Endogeneity of ESG scores cannot be fully ruled out in an observational design: although the sudden onset of the February 2026 restriction reduces the scope for anticipatory ESG upgrading, unobserved firm characteristics correlated with both ESG and resilience may still bias estimates. The sample is restricted to S&P 500 constituents, so external validity to smaller firms and emerging markets is uncertain. Finally, we focus on equity-market outcomes; real-side effects on production, employment or investment are left for future research. We also note that formal placebo tests on pre-event windows and alternative industry definitions of energy exposure would further discipline the design; these are left for revision with extended data access.

Conclusion

In summary, this study provides evidence consistent with H1 and H2: pre-crisis ESG performance is associated with milder equity-market losses during the 2026 Strait of Hormuz crisis. Firms with lower ESG risk scores experienced significantly less negative cumulative abnormal returns at the onset of the restriction. The association remains robust after controlling for firm size and industry fixed effects, and holds under both the market model and the Fama–French five-factor model. The association is most pronounced in multi-day windows around the initial shock and is attributable primarily to the Environmental pillar rather than Social or Governance scores.

These results contribute to the growing literature on ESG as a correlate of resilience under geopolitical and energy-supply disruptions. They suggest that sustainability attributes are associated with milder losses in firm value when critical energy chokepoints are constrained, with implications for sustainable energy security (SDG 7), climate and environmental risk management (SDG 13), and responsible production and investment (SDG 12). Future research should extend the analysis to broader international samples, higher-frequency operational data, and longer post-crisis horizons to assess the persistence of any ESG–return association under stress.

Declarations

Data availability

The datasets analysed during the current study are publicly available from the following sources: (i) daily equity prices from Yahoo Finance (<https://finance.yahoo.com/>); (ii) pre-crisis S&P 500 ESG risk scores (Sustainalytics-style total and pillar scores; snapshot dated 3 March 2021) from a publicly shared S&P 500 ESG dataset used for replication (the processed firm-level file is provided as Supplementary Data and will be deposited with the replication package); (iii) Fama–French five-factor daily returns from Kenneth R. French's Data Library

(https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). Processed analysis datasets and replication code will be deposited in a public repository (e.g., OSF or Zenodo) upon acceptance and are available from the corresponding author upon reasonable request until then.

Code availability

The Python scripts used for data cleaning, event-study calculations, regressions and figure generation will be deposited together with the processed data upon acceptance.

Author contributions

Y.L. (first author) conceived the study, performed the empirical analysis and drafted the manuscript. F.H. (corresponding author) contributed to the research design, interpretation of results and critical revision of the manuscript. Both authors approved the final version.

Ethics, Consent to Participate, and Consent to Publish declarations: not applicable. This study analyses publicly available financial market data and firm-level ESG scores. It does not involve human participants, animals, clinical interventions, or identifiable private information. Therefore, ethics approval, informed consent to participate, and consent to publish are not required.

Ethics approval and consent

Clinical trial registration: not applicable. This study is an observational event-study analysis of equity returns and is not a clinical trial.

Clinical trial registration

Competing interests

The authors declare no competing interests.

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Figures

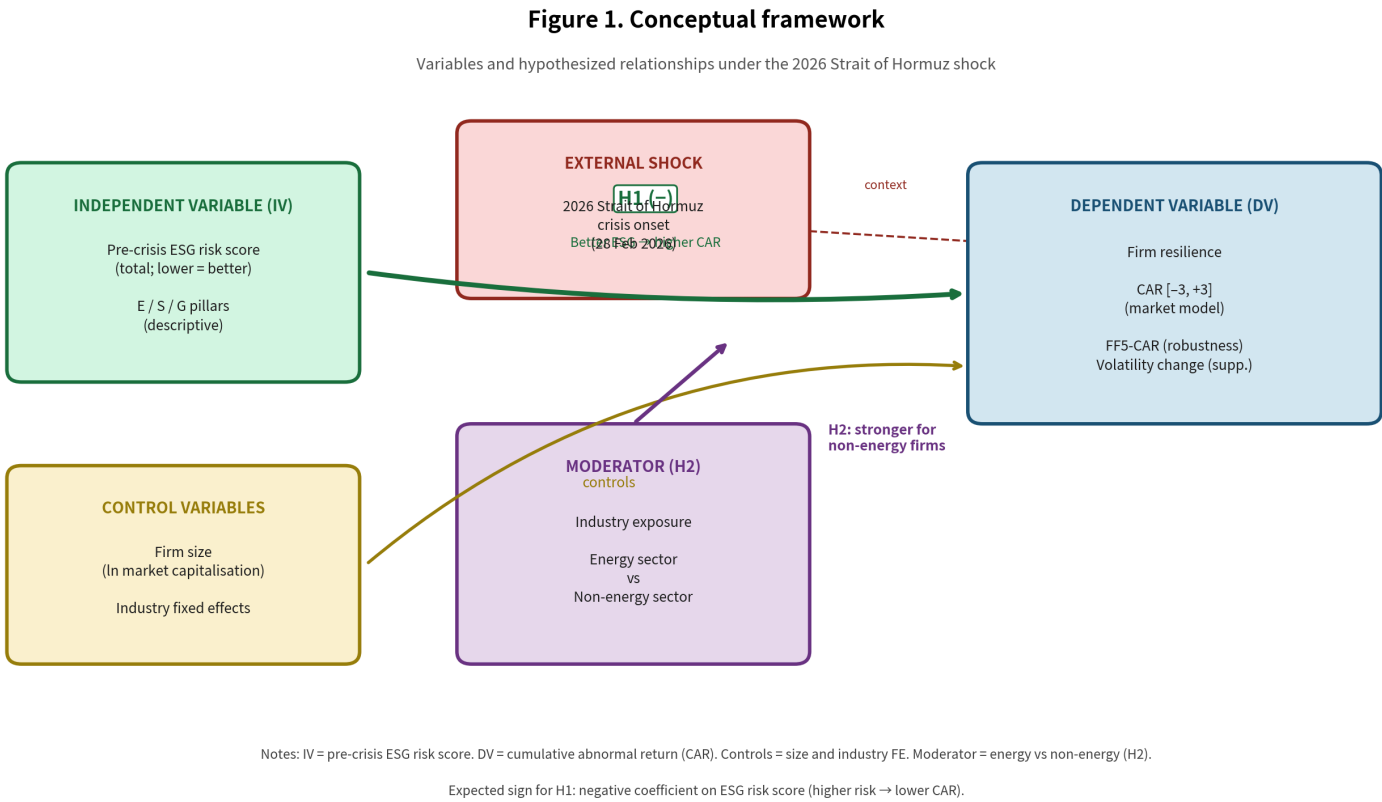


Figure 1

Conceptual framework. Independent variable: pre-crisis ESG risk score (and Environmental pillar under H1b). Dependent variable: equity resilience measured by CAR. Covariates: firm size, valuation ratios and industry fixed effects. Energy versus non-energy is an exploratory diagnostic only (small energy cell). H1 predicts a negative coefficient on ESG risk scores at the Hormuz onset; H1b predicts that the Environmental pillar drives the association.

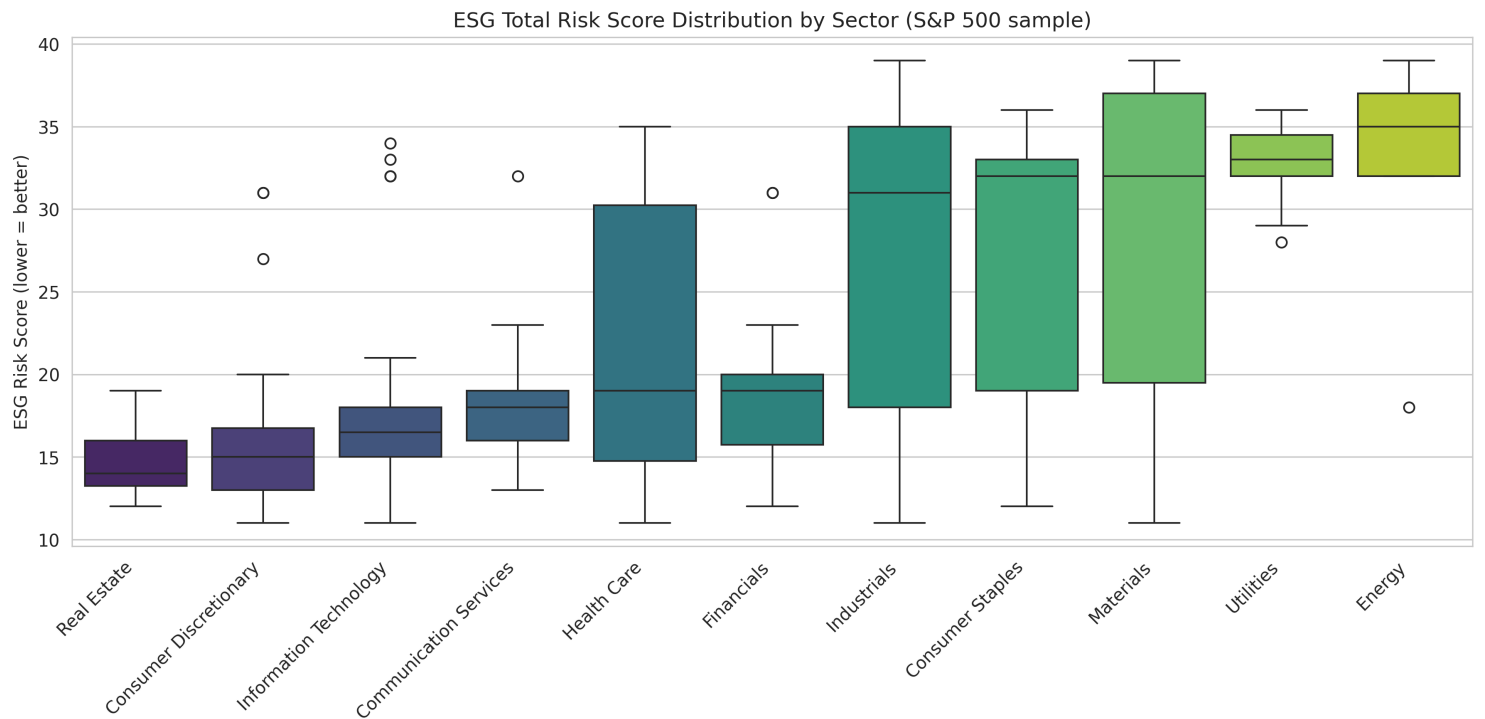


Figure 2

Distribution of ESG total risk scores by sector (S&P 500 sample). Lower scores indicate better ESG performance.

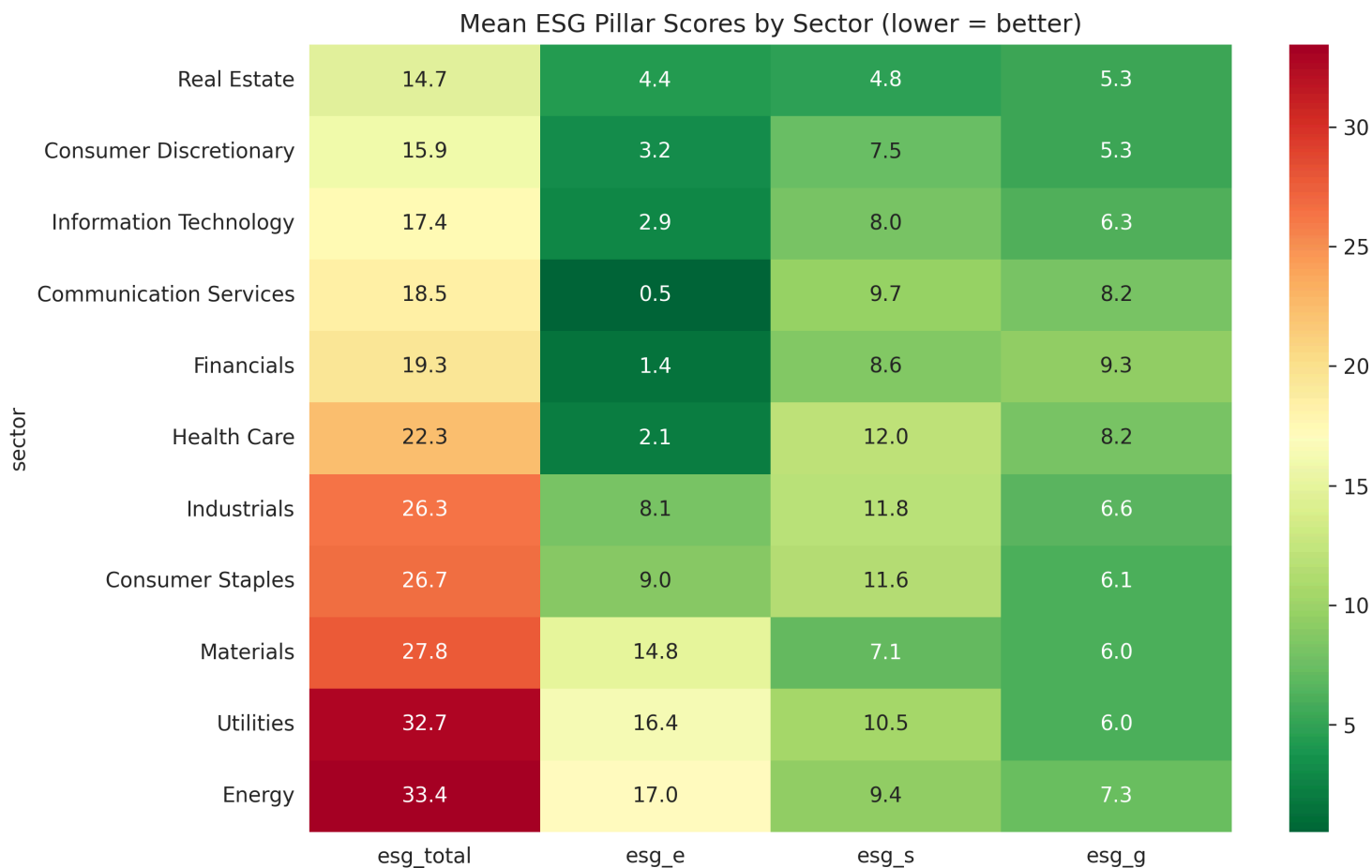


Figure 3

Mean ESG pillar scores (Environmental, Social, Governance) by sector.

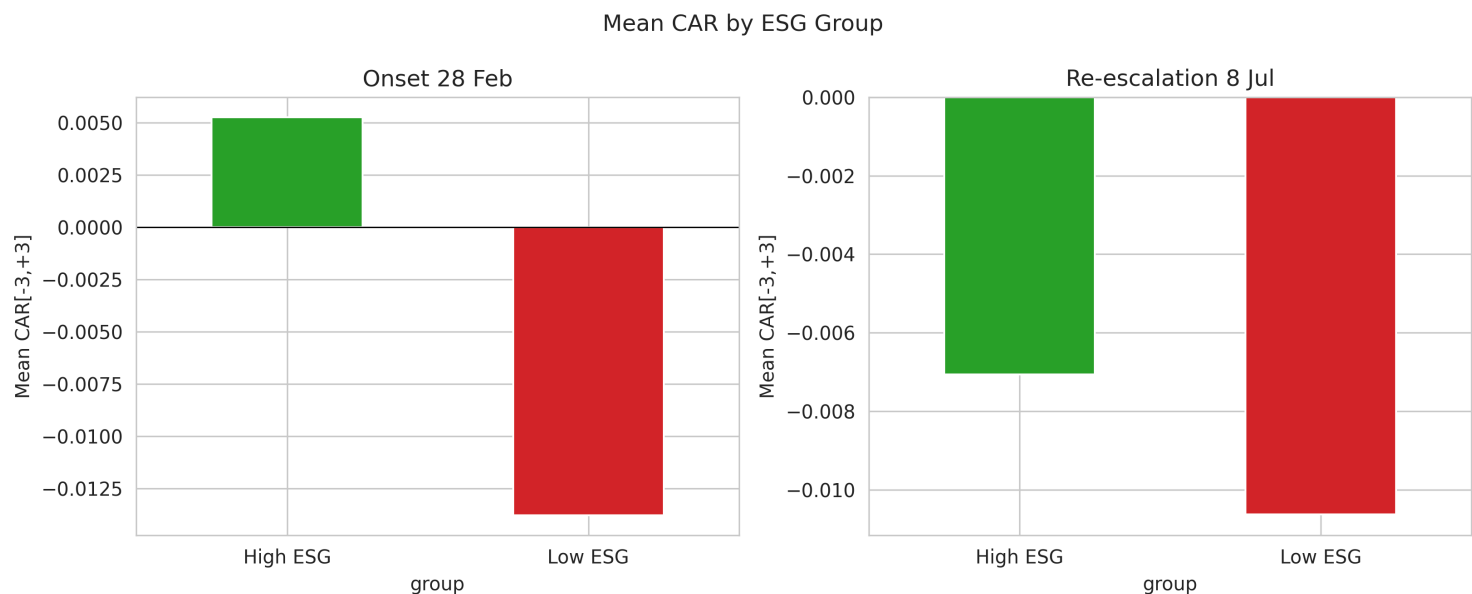


Figure 4

Mean CAR by ESG Group

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Mean cumulative abnormal returns (CAR [-3, +3]) by high- versus low-ESG group around the onset (28 February 2026) and re-escalation (8 July 2026).

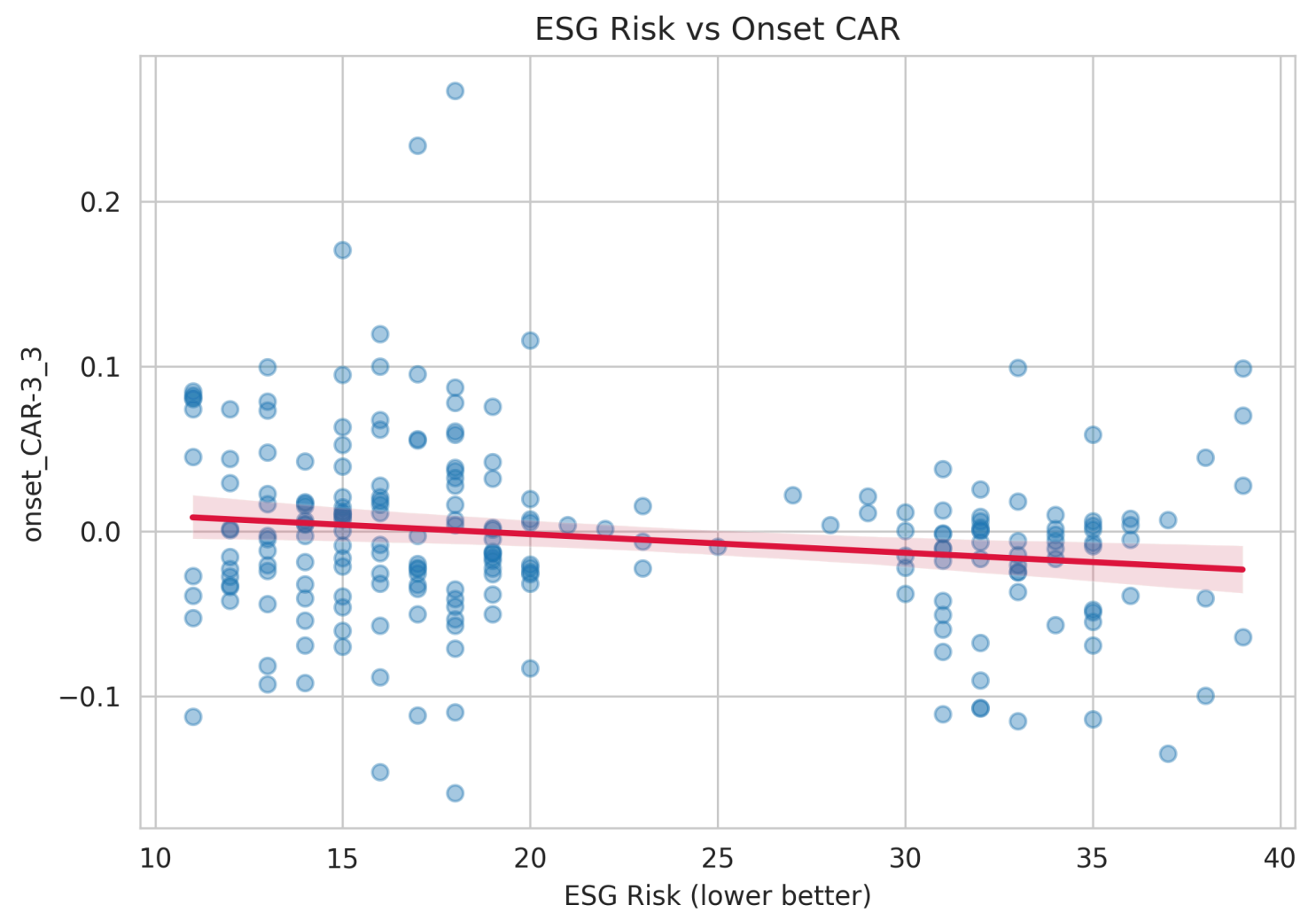


Figure 5

Scatter plot of pre-crisis ESG risk score against onset CAR [-3, +3], with fitted regression line.

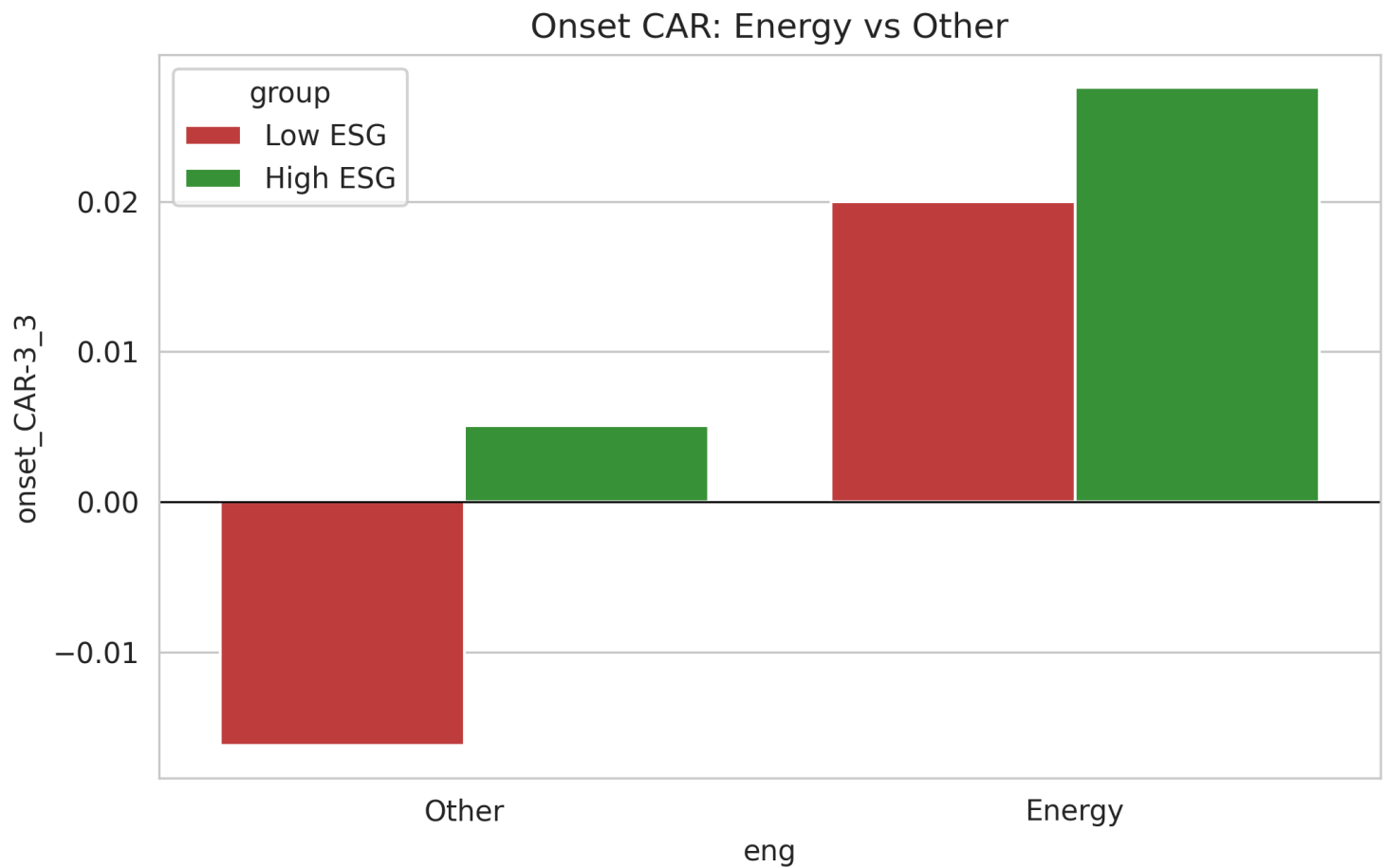


Figure 6

Mean onset CAR [-3, +3] by energy versus non-energy firms, further split by ESG group.

Supplementary Files

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