ESG and Geopolitical Shock: Evidence from the Russia-Ukraine War[1]

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Abstract

This study examines European firms with varying ESG characteristics and their immediate stock price reactions to the outbreak of the Russia-Ukraine war, using an event-study framework. Industry-neutral portfolios are constructed based on overall ESG and individual ESG pillars. The results of the event study analysis reveal that high-ESG portfolios declined, while low-ESG portfolios appreciated, following the outbreak of the war. Portfolios based on individual pillars, specifically high- Social, Government, and Controversy exhibit significant positive abnormal returns at the event onset; these effects were not translated into significant cumulative returns. On the other hand, the low- Social, Government, and Controversy portfolios exhibit significant negative abnormal returns during event window that neither were translated into significant cumulative returns.

Keywords: *event study, European stocks, Russia-Ukraine war, geopolitical risk, ESG*

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Introduction and Motivation

The outbreak of the Russia-Ukraine war represented a geopolitical shock with substantial economic and financial consequences (Capoani et al., 2026). Although warning signals existed before the invasion, e.g., including the annexation of Crimea in 2014, ongoing tensions in the Donbas region, and Russia's military buildup during late 2021, considerable uncertainty remained. For example, if the invasion materializes, at what size, its timing, duration, and what the magnitude of the sanctions, energy-market disruptions, inflationary pressures, and supply-chain effects would be. Due to these uncertainties and their far-reaching consequences, several studies have characterized the Russia-Ukraine war as a Black Swan-type event alongside the COVID-19 pandemic (Yousaf et al., 2022; Chen et al., 2023; Anyikwa and Phiri, 2023; Kyriazis and Corbet, 2024).

The growing importance of environmental, social, and governance (ESG) factors in investment decision-making has generated extensive debate about whether ESG characteristics enhance corporate resilience during periods of market stress. The current empirical evidence, however, remains mixed (Bruna and Lahouel, 2021). On one hand, several studies document a protective role of ESG during crises. Broadstock et al. (2021) report that high-ESG portfolios outperformed lower-rated counterparts during the COVID-19 pandemic, while Lins et al. (2017) show that firms with stronger corporate social responsibility (CSR) engagement experienced less severe declines during the Global Financial Crisis. Similar evidence is provided by Rizwan et al. (2020), Albuquerque et al. (2020), and Lööf et al. (2022), who find that firms with stronger ESG profiles exhibited lower downside risk and more stable performance during periods of heightened uncertainty. In contrast, other studies report little or no resilience effect and suggest that ESG performance may be dependent on the nature of the shock, market conditions, and geographical context (Bae et al., 2021; Costa, 2023).

Several theoretical arguments explain why ESG characteristics may affect stock-market reactions during periods of heightened risk. First, ESG investments may create stakeholder trust and social capital that function as an insurance-like mechanism during adverse events. Firms with stronger ESG profiles often maintain better relationships with employees, customers, suppliers, creditors, and regulators. Therefore, investors are less likely to penalize firms during periods of heightened uncertainty. Godfrey (2005) argues that socially responsible behavior generates moral capital that protects firms during adverse events, while Lins et al. (2017) show that trust capital accumulated in normal times becomes particularly valuable during crises. Second, ESG characteristics signal superior governance, transparency, and risk-management capabilities. Companies with high governance scores often provide more comprehensive disclosures and stronger oversight

mechanisms, reducing information asymmetry and helping investors assess firms' exposure to geopolitical risks. Third, firms with stronger social performance may benefit from more resilient supply chains and stronger supplier relationships (Li et al., 2025). Finally, Albuquerque et al. (2020) show that ESG may reduce downside risk due to stable access to external financing during periods of stress.

These arguments suggest that firms with stronger ESG characteristics may experience less adverse market reactions following a major geopolitical shock. At the same time, existing evidence indicates that any resilience effect may differ across ESG dimensions and may not necessarily persist beyond the immediate reaction period (Brogi et al., 2024).

Our study contributes to the growing body of literature examining the response of higher and lower-rated ESG stocks to unexpected events, specifically the onset of the Russia-Ukraine war. We analyze the stock market reaction of firms in the Euro Stoxx 50 index to the outbreak of the Russia-Ukraine war. Specifically, we compare *high*- and *low*-portfolio returns formed using overall ESG ratings and individual ESG dimensions, including Environmental, Social, and Governance scores, as well as ESG Controversies scores. Following Broadstock et al. (2021), portfolios are constructed using an industry-neutral approach. The purpose of this procedure is to avoid confounding ESG effects with industry effects, as ESG ratings differ systematically across sectors. If portfolios were formed solely based on absolute ESG scores, high- and low-ESG portfolios could become concentrated in different industries, and any observed return differences might reflect sector-specific reactions to the war rather than ESG characteristics themselves.

From a methodological perspective, we employ an event-study framework consistent with Albuquerque et al. (2020), Yousaf et al. (2022), and Kumari et al. (2023). The event-study methodology in our study evaluates whether the outbreak of the Russia-Ukraine war generated abnormal returns relative to each portfolio's normal behavior.

Our findings indicate that portfolios based on overall ESG scores show that *high*-ESG portfolios experience negative abnormal returns following the invasion. In contrast, *low*-ESG portfolios show positive abnormal returns and outperform h*igh*-ESG portfolios in cumulative returns during the event windows. The results for portfolios based on individual ESG pillars show that *high*-Social, *high*-Governance, and *high*-Controversy portfolios exhibit positive and statistically significant abnormal returns immediately following the invasion. However, these effects do not translate into statistically significant cumulative abnormal returns. On the other hand, *low*-Social, Governance and Controversy portfolios demonstrate negative abnormal returns during event window, which translate into significant negative cumulative returns only in *low*-Social portfolio.

1. Data

1.1. Stock Market

We examine the 50 largest and most liquid European companies' constituents of the Euro Stoxx 50 index.[2] The selection of this sample is based on the following factors. (i) The analysis focuses on European companies as they are geographically located close to Ukraine and Russia and (ii) have strong economic ties with them, as evidenced by subsequent inflationary pressures and supply chain disruptions (Mbah and Wasum, 2022). (iii) Empirical evidence indicates that, in the immediate aftermath of the conflict's escalation, European equity markets experienced more pronounced negative price responses than their counterparts in the United States or Asia (Assaf et al., 2023).

Table 1 reports the composition of the Euro Stoxx 50 index by country headquarters and industry sector for 2021. France and Germany dominate the index, jointly accounting for nearly two-thirds of all constituent firms, followed by the Netherlands, which accounts for 14 – 16% of companies. The remaining countries – Spain, Italy, Ireland, Finland, Belgium, and the United Kingdom – are represented by between one and four firms in the sample (index). In terms of sectoral distribution, the index exhibits a relatively balanced structure. Financial services and consumer cyclicals each account for approximately one-fifth of the constituents. Industrials and information technology representing 12% – 14%, while consumer non-cyclicals, basic materials, and healthcare are less prominent 8% – 10%. Utilities and energy sectors have the lowest representation 4% – 6%.

T a b l e 1
Euro Stoxx 50 Index Composition by Country and Industry

Country	2021	Sector	2021
France	32%	Financial Services	18%
Germany	28%	Consumer Discretionary	18%
Netherlands	14%	Industrials	14%
Spain	8%	Technology	14%
Italy	6%	Consumer Staples	10%
Ireland	4%	Basic Materials	8%
Finland	4%	Healthcare	8%
Belgium	2%	Utilities	6%
United Kingdom	2%	Energy	4%

Note: The data reflects the composition of the Euro Stoxx 50 index as of January 1, 2021.
Source: Refinitiv, authors' calculations.

[2] We also considered investigating firms from Central and Eastern Europe, given their geographic proximity to the conflict area and strong economic ties with both Russia and Ukraine. However, these markets were excluded due to limited ESG data availability. Specifically, ESG data were missing for 4 of 9 firms in the Czech PX index, 3 of 20 firms in Poland's WIG20, and 10 of 16 firms in Hungary's BUX index. In Slovakia's SAX index, ESG data were available for only one firm, while no ESG data were available for firms in the OMX Tallinn, OMX Riga, and OMX Vilnius indices with the Refinitiv database.

Daily closing stock prices denominated in euros for the period running from January 2, 2017, to December 30, 2022, and company-related fundamental data (Leverage, B/M ratio, Market Value) were obtained from the Refinitiv platform. The same source was also used to collect data on daily trading volume and the number of shares traded.

1.2. ESG Data

ESG ratings for individual firms in the sample were obtained from the Refinitiv platform. The ESG score is constructed from ten underlying pillars. (i) The environmental pillar comprises: Resource Use, Emissions, and Innovation. (ii) The social pillar comprises: Workforce, Human Rights, Community, and Product Responsibility. (iii) The governance pillar comprises: Management, Shareholders, and CSR Strategy. Both pillar-level scores and sub-scores are reported on a scale from 0 to 100 and are subsequently aggregated into three composite ESG dimensions: (i) Environmental, (ii) Social, and (iii) Governance Pillar Scores. These dimensions are weighted differently based on each factor's relevance to a given industry. For example, social and governance aspects receive greater weight for financial firms, whereas the environmental pillar carries the highest weight for utilities.

The overall ESG score reflects a firm's relative performance. Environmental and social dimensions are assessed relative to industry peers, while governance performance is evaluated against firms operating in the same country. The resulting score represents a percentile ranking ranging from 0 (lowest performance) to 100 (highest performance). For ease of interpretation, Refinitiv also assigns letter grades from A+ to D− corresponding to specific percentile ranges; for instance, an A grade denotes percentiles between 83.33 and 91.66, inclusive. For practical reasons, this study employs the numerical score rather than the letter-grade classification. ESG scores are examined for the period from 2016 to 2021. In Refinitiv, ESG values are reported with a time lag; consequently, scores for a given year such as 2021 are often available only toward the end of the following year (e.g., 2022). We reflect this time lag in calculations. ESG scores are examined for the period from 2016 to 2021 as we calculate cumulative raw returns for *high*- and *low*-ESG portfolios for the period 2017 – 2022.

A separate category outside the overall ESG score is represented by ESG Controversies. ESG Controversies Score is based on the number of ESG-related controversies associated with a firm, including, for example, environmental incidents, breaches of privacy protection, violations of human rights, or accounting-related controversies. The resulting score is again determined by comparing it with other firms in the same industry. Importantly, the number of controversial events is adjusted for firm size to mitigate potential bias arising from greater media coverage

of larger companies, which would otherwise mechanically lead to a higher reported number of incidents. For clarity, the hierarchical structure of Refinitiv's ESG ratings is also summarized in Table A1.[3] The ESG Combined Score is reported for descriptive purposes.

2. Methodology

In the first step, we compute daily logarithmic returns for each individual company in the Euro Stoxx 50 index. Daily log returns are calculated as:

$$R_{it} = ln\left(P_{it} / P_{i,t-1}\right) \tag{1}$$

where R_{it} denotes the daily logarithmic return of asset *i* at time *t*, *ln* represents the natural logarithm, P_{it} is the daily close price of the stock *i* at time *t*, and $P_{i,t-1}$ is the corresponding closing stock price of stock *i* at the previous day (*t*–1). In the following text, the term "asset" mostly refers to either the *low*-ESG or *high*-ESG portfolio. The construction of these portfolios is described in detail in Section 2.2.

2.1. Event Study Methodology

A black swan event is defined as a highly improbable occurrence with severe and far-reaching consequences (Taleb, 2010). Despite several warning signals preceding the escalation (e.g., disputes over Crimea and the Donbas region in 2014, intensified military buildup near Ukraine's borders from late 2021), the full-scale Russian invasion of Ukraine in February 2022 surprised a large share of market participants and triggered substantial disruptions across global financial markets and the real economy (Yousaf et al., 2022). Given the sudden nature of the Russian invasion of Ukraine, an event study framework is applied in this study, as it enables the identification of abnormal stock market reactions to the invasion.[4]

Event study analysis requires identifying the event of interest, the corresponding event date, and the related event windows (Armitage, 1995). February 24, 2022, is adopted as the outbreak date for the Russia-Ukraine war (Yousaf et al., 2022) and as the event date (day *t*). Consistent with Broadstock et al. (2021) and

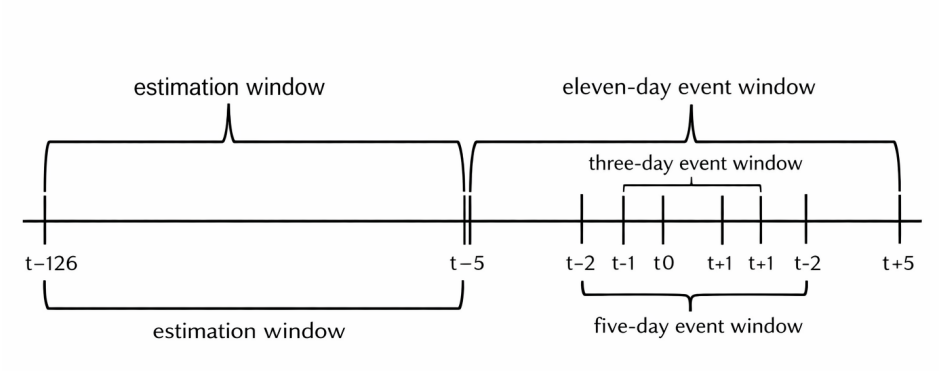
[3] ESG data were not available for Unilever during the examined period 2017 – 2020; therefore, it was excluded from the analysis.

[4] The unexpected nature of the event is further supported by Figures 2 and 3, which present the abnormal returns of the high- and low-ESG portfolios, as well as the Environmental, Social, Governance, and ESG Controversies portfolios, over the event window extending up to five trading days before the outbreak of the war. During this pre-event period, abnormal returns are generally not statistically significant, except for the *low*-ESG portfolio at *t*−2. This pattern suggests that market participants did not systematically anticipate the invasion or adjust their positions in advance, supporting the assumption that the outbreak of the Russia-Ukraine war was an unexpected shock to financial markets.

study robustness, three event windows are examined: (i) a three-day window spanning from *t*–1 to *t*+1, (February 23 – 25, 2022), (ii) a five-day window from *t*–2 to *t*+2 (February 22 – 28, 2022), and (iii) an eleven-day window from *t*–5 to *t*+5 (February 17 – March 3, 2022).

In the second step, the *estimation window* is defined to calculate expected (normal) returns. The estimation window is set before the event window to avoid mutual overlap (MacKinlay, 1997; Krüger, 2015). Consistent with the literature, the estimation window is set to 120 trading days (MacKinlay, 1997; Sayed and Eledum, 2021). Umar et al. (2022), who examine the impact of the war in Ukraine on metals and energy markets, also use the same estimation window. Both the event windows and the estimation window include only trading days. For clarity, all relevant event-study related periods are illustrated in Figure 1.

F i g u r e 1
Timeline of Estimation (pre-event) Window and Event Window



Source: Authors' calculations.

Expected normal returns represent the returns that the portfolios described in section 2.2 would have generated in the absence of the extraordinary event. These returns are estimated with data from the estimation window. A wide range of models has been proposed in the literature to calculate expected returns. These include, for example, the mean-adjusted returns model, which assumes a constant expected return equal to the asset's average return over a given period. Another approach is the market-adjusted returns model, in which the expected return equals the market return; in this case, expected returns vary over time but are identical across securities. More sophisticated alternatives include the Capital Asset Pricing Model (CAPM) and the Fama-MacBeth model (Armitage, 1995; Dyckmant et al., 1984).

The OLS-based market model is the most widely used approach, given its superior performance in event studies (Dyckman et al., 1984), and has been applied in recent studies (Broadstock et al., 2021; He et al., 2021; Yousaf et al., 2022;

Umar, 2022). Under the OLS model, the expected return of asset (portfolio) *i* at time *t* $E(R_{it})$ is estimated as:

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} \tag{2}$$

where R_{mt} represents the return on the selected benchmark asset *m* at time *t*, and α_i and β_i are the parameters of the linear regression model. In this study, expected returns are estimated using daily returns of the Euro Stoxx 50 index (R_{mt}) as the benchmark (Pandey and Kumari, 2021).[5] The next step in the event study methodology involves calculating abnormal returns (*AR*), defined as the difference between the actual returns R_{it} and the expected returns $E(R_{it})$ of an asset (portfolio) during the event window. This relationship can be expressed as follows:

$$AR_{it} = R_{it} - E(R_{it}) \tag{3}$$

where AR_{it} denotes the abnormal return of asset (portfolio) *i* at time *t*, R_{it} is the actual observed return, and $E(R_{it})$ represents the expected return of asset (portfolio) *i* at time *t*. The overall impact of the event on stock return is captured by cumulative abnormal returns (CAR_{it}), which are obtained by summing abnormal returns over the event window:

$$CAR_{it}(\Gamma_1, \Gamma_2) = \sum_{t=\Gamma_1}^{\Gamma_2} AR_{it} \tag{4}$$

where CAR_{it} represents the sum of abnormal returns for asset (portfolio) *i* from time Γ_1 to Γ_2. The advantage of the CAR measure lies in its ability to assess the overall effect of the event on a given asset (portfolio) while mitigating the influence of random day-to-day fluctuations during the event window.

2.1.1. Parametric t-test

The parametric *t-test* is employed in this study, following the methodology described by Brown and Warner (1985) and MacKinlay (1997) and applied in Yousaf et al. (2022) and Umar et al. (2022). The test statistic is calculated:

$$t_{AR_{it}} = \frac{AR_{it}}{\sigma(AR_i)} \tag{5}$$

[5] The Euro Stoxx 50 index is selected as the benchmark because all firms in the sample are constituents of this index. Consequently, the benchmark reflects the market-wide factors that affect the return-generating process of the examined firms. Our objective is to compare the performance of *high*- and *low*-ESG firms within the same large-cap European investment universe, rather than against a broader market index with different market-cap and risk characteristics. This approach is consistent with Broadstock et al. (2021), who construct ESG portfolios from CSI300 constituents and evaluate them within the same market universe.

where AR_{it} denotes the abnormal return of asset *i* at time *t*, and $\sigma(AR_i)$ represents the standard deviation of abnormal returns of asset *i* over the *estimation window*. The standard deviation of abnormal returns is computed using the following formula:

$$\sigma\left(AR_i\right)=\sqrt{\frac{\sum_{t=1}^{n}((AR_{it})-\underline{(AR_i)})^2}{N-1}} \tag{6}$$

where AR_{it} is the abnormal return of asset *i* at time *t*, within the *estimation window*, $(\underline{AR_i})$ denotes the mean abnormal return over the *estimation window*, and *N* is the number of observations in the *estimation window*.

For cumulative abnormal returns (CAR), the test statistic is computed analogously:

$$t_{CAR_i}=\frac{CAR_i}{\sigma\left(AR_i\right)\sqrt{L}} \tag{7}$$

where CAR_i denotes the cumulative abnormal return of asset i over the *event window* (Γ_1, Γ_2), $\sigma\left(AR_i\right)$ is the standard deviation of abnormal returns of asset *i* estimated over the *estimation window*, and *L* represents the number of days in the e*vent window.* The statistical significance of both abnormal returns and cumulative abnormal returns is assessed against Student's *t*-distribution with $N-1$ degrees of freedom, where *N* denotes the number of observations in the *estimation window*.[6]

2.2. Portfolio Construction

This study investigates the immediate reaction of large European companies by ESG score and its pillars values to the onset of Russian-Ukraine war. For this purpose, we build, following portfolios: (i) a *high*-ESG portfolio comprising firms with ESG scores above the median of the Euro Stoxx 50 index, and (ii) a *low*-ESG portfolio consisting of firms with ESG scores below the index median. We build our research on the established theoretical concepts. First, firms with strong stakeholder relationships build trust and social capital, which can reduce operational disruptions during crises (Freeman and McVea, 2005). Second, ESG engagement contributes to reputational capital that may serve as a buffer, leading to less severe investor penalization during negative shocks (Godfrey, 2005). Third, firms with high ESG scores develop valuable intangible assets, such as governance quality

[6] The statistical significance of abnormal returns was additionally verified using a rank-based rustness test, which evaluates whether abnormal returns observed during the event window are unusually high or low relative to the estimation period. The results of this test are reported in Tables 3 and A6 and are consistent with the main findings.

and sustainability practices, which enhance adaptive capacity and long-term competitiveness (Godfrey et al., 2008). Finally, behavioural theories suggest that ESG-oriented investors tend to have longer investment horizons and are less prone to panic selling, contributing to more stable capital flows during periods of market stress (Nofsinger and Varma, 2014). To compare stock price reactions to an unexpected, market-moving event, the outbreak of the war in Ukraine, we constructed *high*- and *low*-ESG portfolios following the approach of Broadstock et al. (2021) in the following way:

(i) We assign each company involved in the Euro Stoxx 50 index either to (i) the *high*- or (ii) *low*-ESG group according to the overall *ESG Score* reported by Refinitiv. If a company's ESG score was above the sector median, the firm was classified as *high*-ESG; otherwise, it was assigned to the *low*-ESG group. To avoid imbalances in sector representation, companies with median ESG scores were included in both groups, with half-weights. This procedure ensured that the *high*- and *low*-ESG portfolios within each sector had the same number of firms.

(ii) Daily returns for the *high*- and *low*-ESG portfolios were computed for each *sector* using equations (8a) and (8b), as suggested by Broadstock et al. (2021).

$$high\_ESG_j = \frac{1}{j^*} \sum R_{ij} h\_ESG_{ij} \, x \, I\left[i \epsilon I_j^* \right] \tag{8a}$$

$$low\_ESG_j = \frac{1}{j^*} \sum R_{ij} l\_ESG_{ij} \, x \, I\left[i \epsilon I_j^* \right] \tag{8b}$$

where j^* is the number of stocks in the sector, R_{ij} is the return of stock *i* in sector *j*, h_ESG_{ij} and l_ESG_{ij} indicates membership in the *high*-ESG or *low*-ESG portfolio, taking the value 1 (the stock belongs to the group) or 0 (the stock does not belong to the group). $I\left[i \epsilon I_j^* \right]$ is an indicator function equal to 1 if stock *i* belongs to sector *j*, and 0 otherwise. The daily returns of the $high\text{-}ESG_j$ portfolio were calculated as the sum of the daily returns of all firms classified as *high*-ESG within the sector, divided by the total number of firms in that sector, both *high*- and *low*-ESG. For example, if the financial sector includes five *high*-ESG and five *low*-ESG firms, the denominator for this calculation was ten, ensuring balanced sector portfolios. The daily returns for the low_ESG_j portfolio were computed in the same manner.

(iii) We computed the daily returns of the sector-neutral portfolios in equations (9a) and (9b). The daily return of the aggregate *high*-ESG portfolio was calculated as a weighted sum of the daily returns of the sector level *high*-ESG portfolios. Since the portfolio has 9 sectors, each was assigned an equal weight of $J = 1/9$.

$$high\_ESG = \frac{1}{J}\sum high\_ESG_j \tag{9a}$$

$$low\_ESG = \frac{1}{J}\sum low\_ESG_j \tag{9b}$$

The use of industry (sector)-neutral portfolios is particularly important in ESG research because some industries systematically receive higher ESG ratings than others due to differences in business models, regulatory requirements, and environmental exposure. For example, utilities and energy firms face fundamentally different environmental challenges than financial institutions or technology firms. If portfolios were formed using absolute ESG scores across the entire sample, the *high*-ESG portfolio could become concentrated in certain industries while the *low*-ESG portfolio could become concentrated in others. In such a case, observed return differences could reflect industry-specific responses to the Russia-Ukraine war rather than ESG characteristics themselves. The sector-neutral approach mitigates this problem by comparing firms to their industry peers and ensuring balanced sector representation in both portfolios.

In the event study analysis, we focused on the portfolios for 2022, the year the war in Ukraine started. To ensure methodological consistency, the same portfolio compositions were used to estimate both the event window (in 2022) and the pre-event window (in 2021). The conceptual assumption is that an investor rebalances the portfolio at the end of 2021, in accordance with the rules outlined above. The investor formed the portfolios for 2022 solely based on the information available at year-end 2021 and the contemporaneous index composition. An equivalent methodological procedure, as described above, was adopted for the construction of portfolios based on individual ESG pillars: (i) the Environmental Pillar Score, (ii) Social Pillar Score, (iii) Governance Pillar Score, and (iv) Controversies Score. For performance analysis of *high*- and *low*-ESG portfolios beyond event window, we calculate Cumulative raw returns (CRR) from 2017 to 2022. Portfolio rebalancing was performed annually, specifically on the final trading day of the year.[7] The rebalancing process incorporated two types of adjustments: (i) changes in the stock index composition, (ii) changes in ESG scores. Over time, firms could transition between the *high*-ESG and *low*-ESG groups as their ESG evaluations can change each year.

Although firms may differ in their exposure to Russia, this concern is mitigated by the industry-neutral portfolio construction. Both the high-ESG and low-ESG portfolios contain firms with business operations in Russia. We present Table A5

[7] The rebalancing was done mainly based on cumulative raw return calculations from 2017 to 2022.

in the appendix, which provides evidence that firms in both portfolios maintained Russian operations prior to the invasion and were subsequently affected by decisions to withdraw, reducing the likelihood that Russia exposure is systematically concentrated in one ESG group.

2.3. Cumulative Raw Returns

To assess portfolio performance beyond the event window (2017 – 2022), we calculated cumulative raw returns (*CRR*), which capture the total portfolio performance over the specified horizon. These returns were computed from the daily returns of the *high*-ESG and *low*-ESG portfolios using Equation (10) (Conrad and Kaul, 1993).

$$CRR = \left(1 + r_{t_1}\right) x \left(1 + r_{t_2}\right) x ..... x \left(1 + r_{t_n}\right) - 1 \tag{10}$$

where r_{t1}, r_{t2} … r_{tn} are daily portfolio returns in time t_1, t_2, ...t_n.

3. Results

We contribute to the literature by providing a comprehensive assessment of how portfolios with different ESG characteristics responded to the outbreak of the Russia-Ukraine war, examining both short-term market reactions and longer-term portfolio performance through a threefold empirical approach. First, in section 3.2, we present industry-neutral *high*- and *low*-ESG portfolios abnormal and cumulative abnormal returns during the event windows. Second, in section 3.3, we analyse differences in trading dynamics by examining variations in trading value and volume across high and *low*-ESG portfolios during and outside the event window. Third, in section 3.4, we evaluate the long-term performance of these portfolios over the 2017 – 2022 period by comparing their cumulative raw returns.

3.1. Descriptive Statistics

Table 2 presents descriptive statistics for the *high*- and *low*-ESG portfolios. The values reflect the information available to investors at the end of 2021, when the portfolios were formed and rebalanced for the year 2022. In addition to ESG scores, we report firm-level financial characteristics, including leverage (total debt to total assets), market value (share price multiplied by shares outstanding), and the book-to-market ratio (B/M) (the ratio of book value per share to the stock closing price per share). The table shows that the mean ESG values are higher for the *high*-ESG portfolio, while the *low*-ESG portfolio exhibits lower mean values. This pattern

is consistent with expectations and serves as a validity check of the portfolio construction. Moreover, the *high*-ESG portfolio shows lower ESG score variability.[8]

T a b l e 2
Descriptive Statistics for *High*- and *Low*- ESG Portfolios

	High ESG portfolio				***Low ESG portfolio***			
Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
ESG	87.38	4.35	80.02	94.67	74.50	9.49	48.09	89.75
E	89.32	6.66	76.27	97.84	74.00	15.63	40.83	95.47
Resource Use	92.34	8.40	67.94	99.84	83.83	23.68	0.00	99.84
Emissions	89.96	10.76	55.76	99.79	85.49	13.12	55.76	99.76
Innovation	82.66	17.05	39.80	99.80	55.03	26.93	0.00	95.74
S	89.71	6.57	70.30	98.83	79.59	14.61	30.84	96.04
Workforce	95.26	4.67	82.31	99.80	89.88	10.69	60.32	99.91
Human Rights	87.21	10.51	51.09	96.31	80.37	20.30	0.00	96.31
Community	89.32	11.53	61.01	99.74	73.89	24.96	5.13	99.39
Product Responsibil.	84.41	17.44	29.65	99.69	74.60	20.97	14.10	99.69
G	81.48	9.59	61.40	95.31	67.87	14.23	41.49	92.78
Management	85.22	12.49	54.66	99.82	74.31	18.68	36.75	99.24
Shareholders	67.72	25.61	11.15	98.20	43.18	23.91	9.62	99.82
CSR Strategy	84.52	13.3	42.21	99.80	72.70	24.30	4.38	99.19
Controversies	58.55	34.27	6.52	100.00	79.53	31.58	1.52	100.00
Leverage	0.27	0.12	0.04	0.51	0.21	0.11	0.02	0.45
B/M	4.75	8.38	0.16	32.68	2.20	4.09	0.07	17.61
Market Value	79.51	44.13	35.01	232.52	100.44	92.23	27.95	366.96

Note: The table reports descriptive statistics for the examined firms for the year 2021. These would be available for investors in the beginning of 2022, when they construct/rebalance portfolios. Leverage is defined as the ratio of total debt to total assets. The book-to-market ratio (B/M) is calculated as the ratio of book value to market value. Market value is expressed in EUR billions. The data are obtained from Refinitiv. Consequently, the high- and low-ESG classifications are relative to sector peers rather than to the entire Euro Stoxx 50 universe. Therefore, it is possible for a firm classified as low ESG within a sector characterized by generally high ESG ratings to have a higher absolute ESG score than a firm classified as high ESG in another sector with lower overall ESG ratings. The overlap in the minimum and maximum ESG scores reported in Table 2 is therefore an expected outcome of the sector-neutral portfolio construction and does not imply a violation of the portfolio assignment procedure.

Source: Refinitiv, authors' calculations.

3.2. Event Study

3.2.1. High and Low ESG Portfolios

This section presents the results of an event study examining the impact of the onset of the Russia-Ukraine war on the returns of *high*- and *low*-ESG portfolios of European companies. The event date is February 24, 2022. On that day, Russian military forces launched a 'special military operation' on Ukraine (Yousaf et al., 2022). Three event windows are analyzed: (i) the eleven-day event window

[8] Firms classified into the high-ESG portfolio do not necessarily exhibit high ESG Controversy scores. In fact, the average Controversy score is lower for the high-ESG portfolio than for the low-ESG portfolio. This reflects the construction of Refinitiv's ESG metrics, where the Controversy score is reported separately and captures a different dimension of corporate behaviour than the overall ESG assessment. The results for the Controversy portfolios should therefore be interpreted as evidence on reputational risk and controversy exposure.

covering the period (from *t–5* to *t*+5), (ii) seven-day event window covering the period (from *t*–3 to *t*+3) and (iii) three-day event window covering the period (from *t*–1 to *t*+1). All event widows are depicted in Figure 1. Sayed and Eledum (2021) propose a 120-day estimation window, as this length is considered ade-quate for estimating normal returns. The analysis examines the statistical signif-icance of abnormal returns (AR) and cumulative abnormal returns (CAR), as shown in Tables 3 and 4 and Figures 2 – 6, and the trading activity of *high*- and *low*-ESG portfolios, as shown in Table 5.

Our study considers two investors: one holding a *high*-ESG portfolio and the other holding a *low*-ESG portfolio. When the war begins, our analysis asks the question: "whether either portfolio experienced returns that differed significantly from what would be expected at normal conditions without the start of the war."

We first calculate abnormal returns for *high*-ESG (AR_high) and *low*-ESG (AR_low) portfolios for the period *t*–5 to *t*+5, using equation 3 and the statistical significance test in equation 5. The results are presented in Table 3 and Figure 2. Although both portfolios exhibit statistically significant effects, their responses differ in direction. Table 3 and Figure 2a reveal a consistent pattern of positive abnormal returns for the *low*-ESG portfolio and negative abnormal returns for the *high*-ESG portfolio on several key event dates: (i) *t*−2 (22 February 2022), likely reflecting the market reaction to Russia's recognition of the Luhansk and Donetsk territories. (ii) t_0 (24 February 2022) – the event day and (iii) *t*+2 (28 February 2022). The abnormal return may be partly attributable to the structure of trading days, as the weekend between *t*+1 and *t*+2 could have delayed the full incorporation of new information into asset prices.[9]

T a b l e 3
Abnormal Returns of *High*- and *Low*- ESG Portfolios during Event Window

Day	AR high-ESG	*t*-stat	*Rank Test*	AR low-ESG	*t*-stat	*Rank Test*
t−5	–0.0016	–0.804	–1.1107	0.0015	1.342	1.2958
t−4	0.0001	0.075	0.4496	0.0012	1.054	1.0842
t−3	–0.0002	–0.11	0.1851	–0.0014	–1.269	–1.4015
t−2	–0.0023	–1.144	–1.2429	0.0024	2.1631**	1.6495*
t−1	0.0007	0.359	0.7140	0.0006	0.489	0.6611
t	–0.0055	–2.7893***	–1.6659*	0.0058	5.1528***	1.6924*
t+1	0.0022	1.104	1.1371	0.0002	0.176	0.2380
t+2	–0.0059	–2.9668***	–1.6924*	0.0063	5.6317***	1.7189*
t+3	–0.003	–1.493	–1.4809	0.0018	1.603	1.5073
t+4	0.0039	1.9701*	1.6531*	–0.004	–3.5570***	–1.6924*
t+5	–0.0033	–1.6777*	–1.5338	–0.0027	–2.3675**	–1.6131

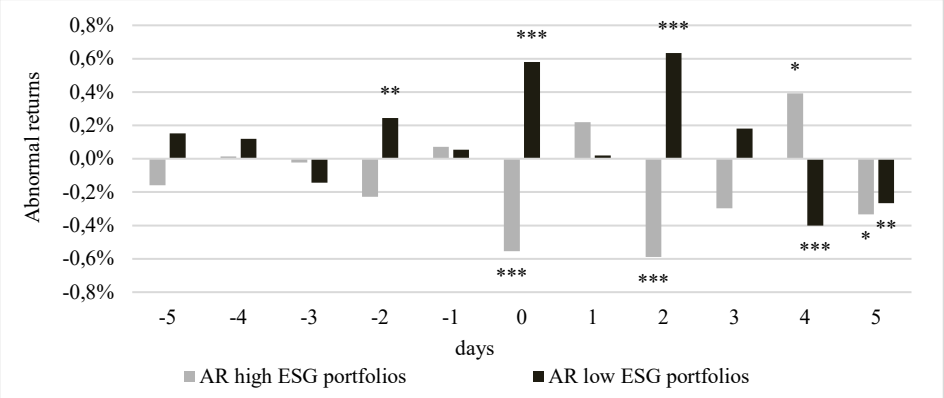
Note: *, **, *** denote significance levels of 10%, 5%, and 1%, respectively.
Rank Test represents rank-based robustness statistics.

Source: Refinitiv, authors' calculations.

[9] The statistical significance of all abnormal returns is also tested using the Rank test reported in Table 3.

F i g u r e 2a

Abnormal Returns of High- and Low-ESG Portfolios during Event Window



Note: *, **, *** denote significance levels for Abnormal returns of 10%, 5%, and 1%, respectively.

Source: Authors' calculations.

Figure 2b and Table 4 illustrate the evolution of cumulative abnormal returns and further support our findings. The *high*-ESG portfolio records negative and statistically significant CARs throughout the event window, while the *low*-ESG portfolio exhibits positive CARs that are statistically significant at the 1% level from t_0 onward. All in all, the results show that *high*-ESG portfolios declined and *low*-ESG portfolios appreciated after the outbreak of the war.

The results in Tables A7 and A8 indicate limited evidence of differential performance between the *high*- and *low*-rated ESG portfolios. The average daily abnormal return difference is negative (−0.24%), suggesting that the l*ow*-ESG portfolio slightly outperformed the *high*-ESG portfolio during the event window; however, the difference is not statistically significant.

T a b l e 4

Cumulative Returns of *High*- and *Low*- ESG Portfolios during Event Window

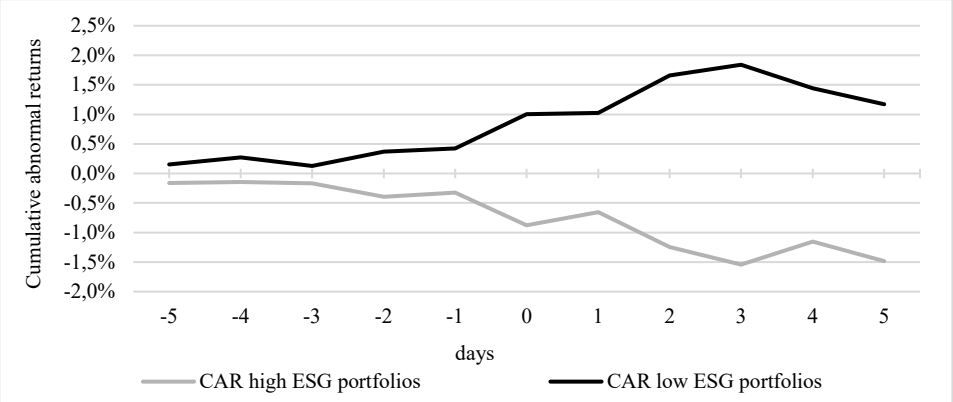
Day	CAR high-ESG	*t*-stat	CAR low-ESG	*t*-stat
t−5	–0.0016	–0.804	0.0015	1.342
t−4	–0.0014	–0.516	0.0027	1.6944*
t−3	–0.0017	–0.485	0.0013	0.651
t−2	–0.0039	–0.992	0.0037	1.645
t−1	–0.0032	–0.727	0.0043	1.6899*
t	–0.0088	–1.8021*	0.0101	3.6462***
t+1	–0.0066	–1.251	0.0103	3.4424***
t+2	–0.0125	–2.2194**	0.0166	5.2112***
t+3	–0.0154	–2.5902**	0.0184	5.4476***
t+4	–0.0115	–1.8343*	0.0144	4.0432***
t+5	–0.0148	–2.2547**	0.0117	3.1412***

Note: *, **, *** denote significance levels of 10%, 5%, and 1%, respectively.

Source: Refinitiv, authors' calculations.

F i g u r e 2b

Cummulative Abnormal Returns of High- and Low-ESG Portfolios during Event Window



Source: Authors' calculations.

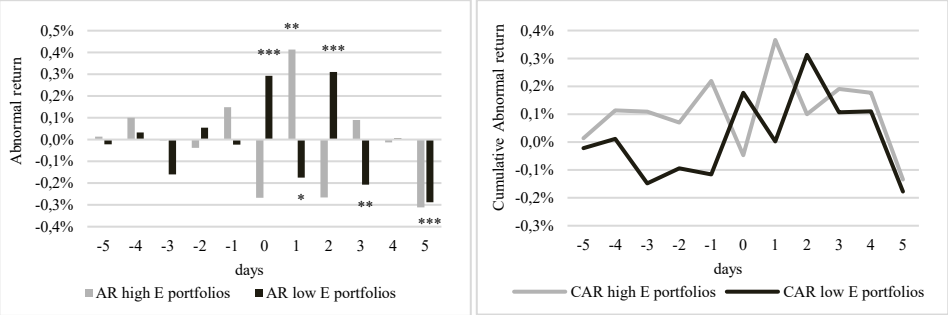
Next, we proceed with a portfolio assignment based on individual ESG dimensions: (i) Environmental, (ii) Social, (iii) Governance, and (iv) ESG controversies. The portfolios are constructed using the same methodology as the *high*- and *low*-ESG portfolios, but with a focus on individual pillar scores (E, S, G, and Controversy). Consequently, each portfolio (*high*-/*low*-E, S, G, and Controversy) comprises a different set of firms than those in the overall ESG score-based portfolios.

3.2.2. High and Low Environment Portfolio

Abnormal returns for the *high*-environmental (E) portfolio are positive and significant at $t+1$, whereas the *low*-environmental portfolio exhibits more frequent, yet sign-inconsistent, significant effects. Although the abnormal return (AR) of the *high*-E portfolio is positive at $t+1$, the statistical significance dissipates in subsequent days, and the magnitude of ARs is insufficient to generate statistically significant CARs over the event window. One possible explanation is that *high*-E firms are more frequently concentrated in sectors with lower cyclical sensitivity (e.g., finance and healthcare), which may provide greater stability prior to the event but limit upside potential during periods of heightened market turbulence. This interpretation is consistent with the empirical results.

The *low*-E portfolio exhibits positive and statistically significant CARs at 3-day and 5-day event windows. Several factors may account for this pattern. First, firms with lower environmental scores may be more exposed to sectors (e.g., industrials, energy, transportation) that initially benefited from shifts in commodity prices or market sentiment after the onset of the conflict, generating short-term positive CARs.

F i g u r e 3
Abnormal and Cumulative Returns of *High*- and *Low*- Environmental Portfolios during Event Window



Note: *, **, *** denote significance levels for Abnormal returns of 10%, 5%, and 1%, respectively.
Source: Authors' calculations.

3.2.3. High and Low Social (S), Governance (G), and ESG Controversies Portfolios (EC)

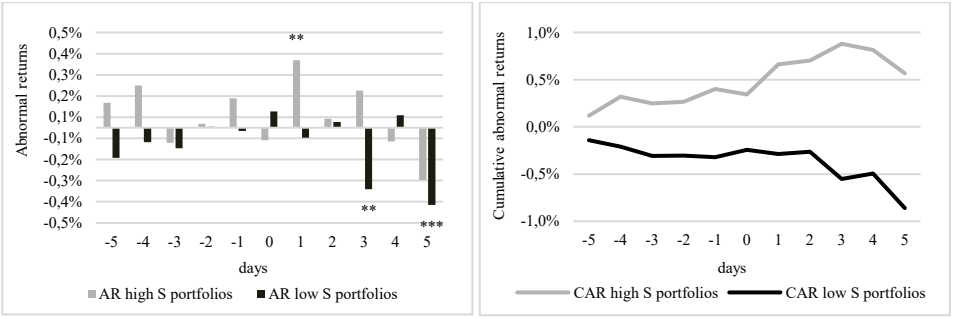
Two channels related to Social and Governance Score may account for company stability. First, stronger stakeholder relationships can lead to more stable customer demand. Luo and Bhattacharya (2009) and Albuquerque et al. (2019) argue that firms with higher ESG engagement benefit from greater customer loyalty and lower price sensitivity, which helps sustain profit margins during adverse shocks. Such revenue stability may translate into lower stock price volatility. Second, investor composition effects may contribute to resilience: ESG-oriented investors often adopt longer investment horizons and exhibit lower turnover, thereby reducing the systematic risk exposure of *high*-ESG stocks.

We document in Figures 4 – 6 and Tables A4, A6 that *high*-S, *high*-G, and *high*-EC portfolios show positive, statistically significant abnormal returns immediately following the invasion (*t+0, t+1*). However, these effects do not persist across larger event windows. The evidence suggests significant negative abnormal returns three (*low*-S) to five trading days after the event for *low*-S, *low*-G, and *low*-Controversy portfolios.[10]

CARs are positive but not significant for the *high*-S, *high*-G, and *high*-Controversy portfolios and negative but not significant for their *low*-S, *low*-G, and *low*-EC counterparts (table A4). On the last event day at *t*+5, a sharp drop in CAR is observed for all *low*-S, G, EC portfolios, thought significant only for *low*-S portfolio. That day (March 3rd) is associated with news related to the attack on the Zaporizhzhia nuclear power plant (Rezmer and Szpak, 2024).

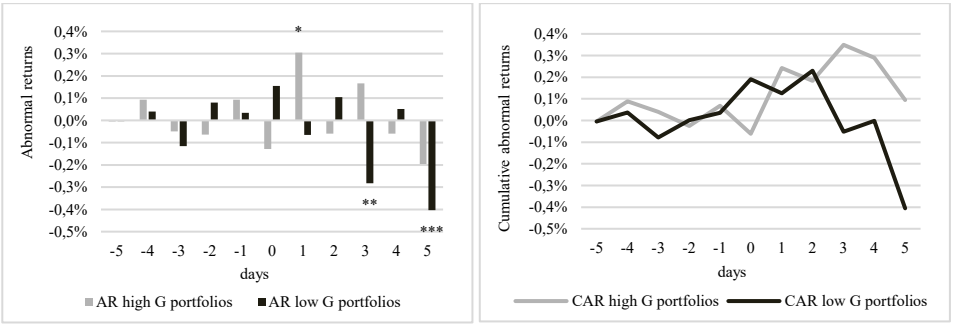
[10] The statistical significance of all abnormal returns is also tested using the Rank test reported in Table A6.

F i g u r e 4
Abnormal and Cumulative Returns of *High*- and *Low*- Social Portfolios during Event Window



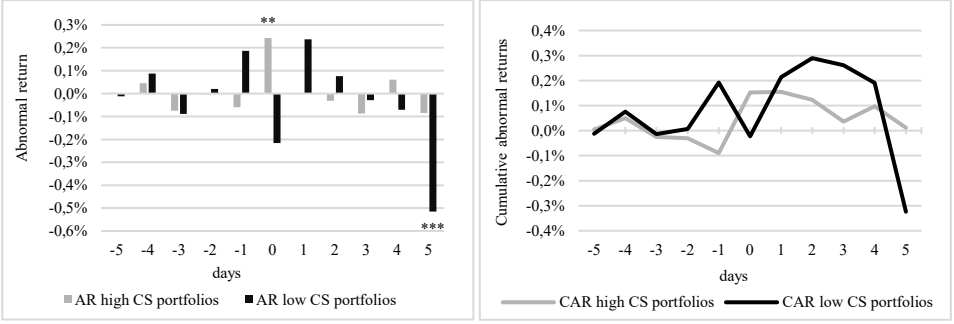
Note: *, **, *** denote significance levels for Abnormal returns of 10%, 5%, and 1%, respectively.
Source: Authors' calculations.

F i g u r e 5
Abnormal and Cumulative Returns of *High*- and *Low*- Governance Portfolios during Event Window



Note: *, **, *** denote significance levels for Abnormal returns of 10%, 5%, and 1%, respectively.
Source: Authors' calculations.

F i g u r e 6
Abnormal and Cumulative Returns of *High*- and *Low*- Controversy Portfolios during Event Window



Note: *, **, *** denote significance levels for Abnormal returns of 10%, 5%, and 1%, respectively.
Source: Authors' calculations.

Overall, the evidence suggests that some ESG dimensions, particularly the Social, Governance, and Controversy pillars were associated with positive immediate market reactions following the invasion. Although we document positive CAR during the event window, they are not significant. On the other hand, the *low*-Social, Governance, and Controversy portfolios experience negative abnormal returns from t+3 to t+5, with declining cumulative returns at the end of the event window, though not significant.

The event-study methodology results presented above evaluate whether abnormal returns and cumulative abnormal returns differ significantly from each portfolio's own expected return estimated during the pre-event period. Consequently, these tests assess whether the outbreak of the Russia-Ukraine war led to abnormal performance relative to normal portfolio behavior. However, they do not directly assess whether the reactions of *high*- and *low*-rated portfolios differ. Tables A7 and A8, therefore, provide complementary evidence by formally testing differences in abnormal and cumulative abnormal returns between the two examined groups of portfolios.

Table A7 reports a comparison of the daily abnormal returns (ARs) of the high- and low-rated portfolios during the 11-day event window (t−5 to t+5). Specifically, the table presents the mean daily abnormal return difference (high-low AR), together with the corresponding t-statistic and p-value testing whether the average difference is significantly different from zero. (i) For the aggregate ESG portfolio, the mean difference is negative (−0.24% per day), indicating that the low-ESG portfolio outperformed the high-ESG portfolio on average; however, the difference is not statistically significant. (ii) For the Environmental pillar, the average difference is close to zero and statistically insignificant. (iii) The Social pillar exhibits a positive and statistically significant mean difference of 0.13% per day, indicating that the high-S portfolio outperformed the low-S portfolio during the event window. In contrast, (iv) the Governance and (v) ESG Controversies portfolios show positive but statistically insignificant average differences. Overall, the results provide evidence of a significant difference between the *high*- and *low*-rated portfolios only for the Social dimension.

We also compare the cumulative abnormal returns (CARs) of the *high*- and *low*-rated portfolios across the event windows. The difference in CARs test examines whether the cumulative market reaction differs between the *high*- and l*ow*-rated portfolios (ΔCAR). This approach assesses whether firms in the two examined portfolios experienced significantly different cumulative stock-market reactions following the outbreak of the Russia-Ukraine war.

The results in Table A8 indicate that only the Social dimension exhibits a statistically significant difference for cumulative returns between the *high*- and

low-rated portfolios. For the eleven-day event window, the *high*-S portfolio outperformed the *low*-S portfolio by 1.43 percentage points.

3.3. Trading Activity

In addition to price returns, we also investigate the trading activity, captured by the number of shares traded. Extraordinary events trigger increased market activity as investors adjust their portfolios (Zaremba et al., 2021). Trading activity is calculated separately for the *high*- and *low*-ESG portfolios, as well as for the entire Euro Stoxx 50 index. Table 5 shows average daily trading volume for two periods: (i) period representing the onset of the Russia-Ukraine war spanning from 24 February to 3 March 2022, and (ii) period not affected by war corresponding to the same period one year ago (24 February – 3 March 2021) (Broadstock et al., 2021). Daily trading volume rose substantially at the beginning of the Russia-Ukraine conflict, consistent with prior empirical evidence (e.g., Broadstock et al., 2021). However, in contrast to their findings, the expansion in trading volume was more pronounced for *high*-ESG firms (50.74%) than for the *low*-ESG group (34.74%).

T a b l e 5
Average Daily Trading Volume

	Average daily trading volume			
Group	**Estimation window**	**Event window**	**Difference**	***t*-stat.**
Euro Stoxx 50	373,571,865	548,954,694	175,382,829	4.1668***
High ESG firms	285,026,961	429,649,934	144,622,973	4.3134***
Low ESG firms	88,544,904	119,304,760	30,759,856	3.4386***
High minus Low ESG firms	196,482,057	310,345,174	113,863,117	4.5124***

Note: Average daily trading volume is calculated as the daily average of number of shares traded during estimation and event window. Event window spans from 24 February to 3 March 2022 corresponding to *t–5* to *t+5* event window. Estimation window corresponds to the same period one year ago (24 February – 3 March 2021). A two-sample *t*-test was used to compare trading volumes.

Source: Refinitiv, authors' calculations.

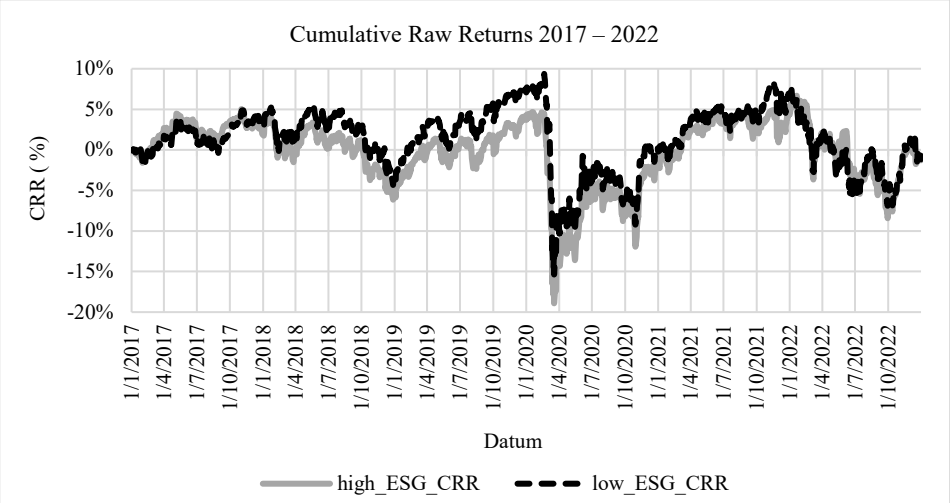
3.4. Cumulative Portfolio Returns

To provide another evidence for our study, we compute cumulative raw returns for *high*- and *low*-ESG portfolios over a longer period than the event study analysis covers. Figure 7 presents cumulative raw returns (CRR) for the *high*- and *low*-ESG industry-neutral portfolios covering the period from January 2, 2017, to December 30, 2022. The sample period spans from 2017, when ESG data became available, to 2022, marking the onset of the Russia-Ukraine war. Figure 7 provides an overview of the cumulative performance of *high*- and *low*-ESG portfolios over this

extended period, complementing the event study analysis, which focuses specifically on market reactions to the outbreak of the war. The longer time horizon captures several distinct economic phases, including the economic growth after post-European debt crisis, the COVID-19 pandemic in 2020, and the geopolitical shock associated with the start of the war in February 2022. Additionally, Table 6 presents complementary portfolio statistics: maximum drawdown, annualized mean return, annualized standard deviation, and the Sharpe ratio.

F i g u r e 7

Cumulated Raw Returns



Note: Cumulative raw returns for 'industry neutral' high- vs low-ESG portfolios between January 1, 2017 till October 1, 2022: This figure plots the cumulative raw returns for industry neutral high- vs low-ESG European stock over time.

Source: Authors' calculations.

Both Figure 7, which presents cumulative raw returns, and Table 6, which reports portfolio statistics, indicate broadly similar performance of *high*- and *low*-ESG portfolios over the period 2017 – 2022.

T a b l e 6

Portfolio Statistics for *High*- and *Low*- ESG Portfolios Constructed 2017 – 2022

Portfolio	CRR	Avg. Return	Std. Dev.	MDD	Sharpe Ratio
High ESG	–1.29%	0.27%	9.79%	23.99%	0.0274
Low ESG	–1.18%	0.27%	9.62%	22.62%	0.0281

Note: Industry neutral high- and low-ESG portfolios from January 1, 2017 to December 30, 2022: CRR – cumulative raw returns, Avg. Return – annualized average return, std. dev – annualized standard deviation of portfolio returns, MDD – maximum portfolio drawdown, Sharpe ratio.

Source: Refinitiv, authors' calculations.

In particular, the two portfolios exhibit comparable annualized average returns and risk characteristics, as measured by standard deviation, maximum drawdown, and the Sharpe ratio. However, Figure 7 suggests that the *low*-ESG portfolio exhibits marginally higher cumulative raw returns over the 2017 – 2022 period. Although the difference is economically small and no formal statistical inference is intended.

Conclusion

This study shows the immediate reaction of the largest European companies divided into two industry-neutral portfolios according to their ESG and individual pillar scores (E, S, G, Controversies) classification to the outbreak of the Russia-Ukraine war using the Event Study Methodology.

Our findings indicate that the abnormal returns of *high*-ESG portfolios declined and the *low*-ESG portfolios rose right after the onset of the war. This pattern is also observed via negative cumulative returns for the *high*-ESG portfolio and positive cumulative returns for the *low*-ESG portfolio.

When disaggregating the overall ESG score into individual pillars: Environmental (E), Social (S), Governance(G), and ESG controversies (Controversy), we observe similar patterns for high-S, G, and Controversy portfolios in the form of short-term positive abnormal returns immediately following the event (t+0 or t+1), though this positive reaction is not sustainable through a wider event window. The cumulative abnormal returns are positive; however, they are not statistically significant. At the same time, firms classified in l*ow*-S, G, and Controversy-rated portfolios experience a statistical negative abnormal return from t+3 to t+5 days after the war outbreak. Statistical comparison of the abnormal returns and cumulative returns between *high*- and l*ow*- ESG, E, S, G, and Controversy portfolios, demonstrates that only the abnormal and cumulative returns for Social pillar are statistically significantly different between *the high*- and *low*-rated portfolios, indicating that firms with stronger Social characteristics experienced a more favorable short-term market reaction to the outbreak of the Russia-Ukraine war than firms with weaker social performance.

Our mixed results indicate that short-term stock price reactions to the outbreak of the war were likely driven by macroeconomic and geopolitical factors rather than ESG characteristics. While *high*-ESG firms may exhibit stronger investor and customer loyalty, they are not isolated from large systemic shocks. ESG factors appear to reflect rather slow-moving fundamentals that influence long-term valuation rather than short-term market responses to geopolitical events.

The findings suggest that ESG metrics may be more informative for assessing long-term corporate characteristics than short-term resilience to extreme geopolitical shocks. Also, they should be considered as complementary indicators in combination with broader risk management frameworks rather than stand-alone indicators.

This study is subject to several limitations. First, the analysis focuses on large, highly liquid firms in the Euro Stoxx 50 index that exhibit high and homogeneous ESG scores, potentially limiting portfolio variation. Second, the event study framework captures short-term market reactions and may not fully reflect longer-term valuation effects associated with ESG performance. Third, the findings are based on a single geopolitical event, which may limit the generalization Fourth, although we construct industry-neutral portfolios to reduce heterogeneity arising from sector composition and to mitigate the influence of sector-specific characteristics. This approach does not control for other firm-specific characteristics, such as market capitalization, leverage, book-to-market ratios, or other financial attributes that may also affect firms' responses to examined stress period. In addition, our analysis does not explicitly account for differences in firms' economic exposure to Russia prior to the outbreak of the war. Nevertheless, Table A5 shows that 44 of the 50 firms in the sample had some form of business activity in Russia before the invasion.

We are aware of the limits of our research. Future research could extend the analysis to more diverse samples, including small and mid-cap firms or firms from emerging European markets, where ESG dispersion is likely greater. Additionally, examining multiple geopolitical events or incorporating alternative ESG measures could provide further insights into the conditions under which ESG characteristics influence firm resilience. Future research could investigate the role of firm-specific characteristics and varying degrees of economic exposure to Russia in shaping stock-market reactions to geopolitical shocks, or over longer event windows.

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Appendix

Table A1
ESG Score in Refinitiv, Its Pillars, and Assessed Categories

	Pillar	Components
	ESG Score: Overall Score Performance: E + S + G	*Environmental Pillar:* Resource Use; Emissions; Innovation
ESG combined		*Social Pillar*: Workforce; Human Rights; Community; Product Responsibility
		Governance Pillar: Management; Shareholders; CSR Strategy
	ESG Controversies: Human Rights Controversies; Product Delays; Environmental Controversies	

Source: Refinitiv, authors' calculations.

Table A2
List of Companies and Their ESG Portfolio Classification

Company	ESG Portfolio	Industry Sector	Company	ESG Portfolio	Industry Sector
Siemens AG	High	Industrials	Kone Oyj	Low	Industrials
Vinci SA	High	Industrials	Schneider Electric SE	Low	Industrials
Airbus SE	High	Industrials	Safran SA	Low	Industrials
Stellantis NV	High	Cons. Dis. (Auto)	Hermès International SCA	Low	Con. Dis.
Mercedes-Benz Group AG	High	Cons. Dis. (Auto)	Flutter Entertainment PLC	Low	Con. Dis.
CRH plc	High	Materials	Kering SA	Low	Con. Dis.
Bayerische Motoren Werke AG	High	Cons. Dis. (Auto)	Volkswagen AG	Low	Cons. Dis. (Auto)
Adidas AG	High	Con. Dis.	LVMH	Low	Con. Dis.
Danone SA	High	Con. Staples	Pernod Ricard SA	Low	Con. Staples
Anheuser-Busch InBev SA	High	Con. Staples	Ahold Delhaize NV	Low	Con. Staples
BASF SE	High	Materials	Air Liquide SA	Low	Materials
Banco Bilbao Vizcaya Argentaria SA	High	Financials	Adyen NV	Low	IT
Banco Santander SA	High	Financials	Deutsche Börse AG	Low	Financials
Intesa Sanpaolo SpA	High	Financials	Munich Re AG	Low	Financials
BNP Paribas SA	High	Financials	ING Groep NV	Low	Financials
Allianz SE	High	Financials	AXA SA	Low	Financials
SAP SE	High	IT	Prosus NV	Low	Communication
Deutsche Telekom AG	High	Communication	ASML Holding NV	Low	IT
Sanofi SA	High	Healthcare	Philips NV	Low	Healthcare
Bayer AG	High	Healthcare	EssilorLuxottica SA	Low	Healthcare
Enel SpA	High	Utilities	Iberdrola SA	Low	Utilities
TotalEnergies SE	High	Energy	Eni SpA	Low	Energy
Linde plc	Both	Materials	Deutsche Post AG	Both	Industrials
Vonovia SE	Both	Real Estate	Inditex	Both	Con. Dis.
Infineon Technologies AG	Both	IT	L'Oréal SA	Both	Con.Staples

Note: The table represents the list of firms included in the EURO STOXX 50 index. Based on ESG scores available at the end of 2021, companies are assigned to the corresponding high- or low-ESG portfolios used in the 2022 analysis.

Source: Refinitiv, authors' calculations.

T a b l e A3
Descriptive Statistics All Companies

Variable	Mean	Std. Dev.	Min.	Q25	Median	Q75	Max.
ESG	80.67	10.27	48.09	74.85	82.72	88.51	94.67
E	81.25	14.76	40.83	71.46	85.37	93.83	97.84
Resource Use	87.40	18.91	0	87.14	94.38	97.95	99.84
Emissions	87.97	11.91	55.76	84.99	91.51	96.41	99.79
Innovation	68.53	27.01	0	50.00	78.18	94.55	99.80
S	83.99	12.88	30.84	79.74	87.58	93.38	98.83
Workforce	92.07	9.01	60.32	89.43	95.18	98.48	99.91
Human Rights	83.22	16.99	0	78.07	91.06	93.14	96.31
Community	81.10	21.64	5.13	69.37	90.45	97.24	99.74
Product Responsibility	78.33	20.61	14.10	70.55	84.00	94.37	99.69
G	74.97	14.49	41.49	67.04	78.52	85.88	95.31
Management	80.21	17.21	36.75	70.54	84.54	93.90	99.82
Shareholders	55.34	27.59	9.62	30.71	54.43	80.48	99.82
CSR Strategy	78.82	20.74	4.38	69.24	81.48	94.31	99.80
Controversies	66.75	35.44	1.52	29.02	75.52	100.00	100.00
ESG Combined	68.03	13.39	41.48	56.33	71.29	79.90	89.75
Leverage	0.23	0.12	0.02	0.16	0.22	0.32	0.51
B/M	3.83	7.02	0.07	0.39	0.90	2.14	32.68
Market Value	88.39	73.32	27.95	46.04	70.79	95.69	366.96

Note: The table reports descriptive statistics for the examined firms for the year 2021. Leverage is defined as the ratio of total debt to total assets. The book-to-market ratio (B/M) is calculated as the ratio of book value to market value. Market value is expressed in EUR billions. The data are obtained from Refinitiv.

Source: Refinitiv, authors' calculations.

T a b l e A4
Cumulative Abnormal Returns across ESG Dimensions

ESG Dimension	Event Window	CAR High	t-stat	CAR Low	t-stat
Environmental (E)	3-day	–0.0016	–0.4662	0.0033	1.8155*
	5-day	–0.0001	–0.0194	0.0046	1.9937**
	11-day	–0.0013	–0.2090	–0.0018	–0.5168
Social (S)	3-day	0.0040	1.4882	0.0001	0.077
	5-day	0.0046	1.3229	0.0005	0.1802
	11-day	0.0057	1.1078	–0.0086	–2.3209**
Governance (G)	3-day	0.0027	0.9324	0.0012	0.6249
	5-day	0.0014	0.3893	0.0031	1.2059
	11-day	0.0009	0.1707	–0.0041	–1.0681
Controversies (CS)	3-day	0.0018	1.1213	0.0021	0.612
	5-day	0.0015	0.7025	0.003	0.6953
	11-day	0.0001	0.0386	–0.0032	–0.4999

Notes: CAR denotes cumulative abnormal returns. *t*-stat represents the *t*-statistics. The 3-day, 5-day, and 11-day windows correspond to event windows around the event date, * denote significance at the 10% and ** at 5% levels, respectively.

Source: Refinitiv, authors' calculations.

T a b l e A5
Euro Stoxx 50 Firms, ESG Portfolio Classification, and Yale CELI Database

Company	Industry	ESG Portfolio	Yale Grade	Company	Industry	ESG Portfolio	Yale Grade
Siemens AG	Industrials	High	F	Kone Oyj	Industrials	Low	B
Vinci SA	Industrials	High	F	Schneider Electric SE	Industrials	Low	A
Airbus SE	Industrials	High	D	Safran SA	Industrials	Low	B
Stellantis NV	Cons. Dis. (Auto)	High	B	Hermès International SCA	Con. Dis.	Low	B
Mercedes-Benz Group AG	Cons. Dis. (Auto)	High	A	Flutter Entertainment PLC	Con. Dis.	Low	B
CRH plc	Materials	High	A	Kering SA	Con. Dis.	Low	B
Bayerische Motoren Werke AG	Cons. Dis. (Auto)	High	B	Volkswagen AG	Cons. Dis. (Auto)	Low	B
Adidas AG	Con. Dis.	High	C	LVMH	Con. Dis.	Low	A
Danone SA	Con. Staples	High	B	Pernod Ricard SA	Con. Staples	Low	B
Anheuser-Busch InBev SA	Con. Staples	High	A	Ahold Delhaize NV	Con. Staples	Low	N/A
BASF SE	Materials	High	A	Air Liquide SA	Materials	Low	A
Banco Bilbao Vizcaya Argentaria SA	Financials	High	N/A	Adyen NV	IT	Low	N/A
Banco Santander SA	Financials	High	N/A	Deutsche Börse AG	Financials	Low	A
Intesa Sanpaolo SpA	Financials	High	D	Munich Re AG	Financials	Low	B
BNP Paribas SA	Financials	High	B	ING Groep NV	Financials	Low	F
Allianz SE	Financials	High	C	AXA SA	Financials	Low	F
SAP SE	IT	High	C	Prosus NV	Communication	Low	B
Deutsche Telekom AG	Communication	High	A	ASML Holding NV	IT	Low	D
Sanofi SA	Healthcare	High	D	Philips NV	Healthcare	Low	D
Bayer AG	Healthcare	High	D	EssilorLuxottica SA	Healthcare	Low	C
Enel SpA	Utilities	High	A	Iberdrola SA	Utilities	Low	N/A
TotalEnergies SE	Energy	High	D	Eni SpA	Energy	Low	F
Linde plc	Materials	Both	C	Deutsche Post AG	Industrials	Both	B
Vonovia SE	Real Estate	Both	N/A	Inditex	Con. Dis.	Both	A
Infineon Technologies AG	IT	Both	A	L'Oréal SA	Con.Staples	Both	B

Note: The table reports the industry classification, ESG portfolio assignment, and Yale CELI Russia withdrawal grade for each sample firm. Yale grades range from A (complete withdrawal from Russia) to F (continuing operations in Russia) and are reported for descriptive purposes only. Table provides evidence that firms in both portfolios maintained Russian operations prior to the invasion. Data are from the Yale CELI database (Yale Companies Leaving and Staying in Russia – Simplified Version), accessed on 15 June 2026.

Source: <https://www.yalerussianbusinessretreat.com/simplified-version>.

Table A6

Rank-Based Robustness Test of *High*- and *Low*- E, S, G, and Controversy Portfolios Abnormal Returns

Day	E_AR_H	Rank Test	E_AR_L	Rank Test	S_AR_H	Rank Test	S_AR_L	Rank Test	G_AR_H	Rank Test	G_AR_L	Rank Test	C_AR_H	Rank Test	C_AR_L	Rank Test
t–5	0.0001	0.3967	–0.0002	–0.1851	0.0012	0.9256	–0.0014	–1.4015	0.0000	0.2909	0.0000	–0.1058	0.0000	0.0793	–0.0001	0.1587
t–4	0.0010	0.7933	0.0003	0.4231	0.0020	1.2429	–0.0007	–0.7404	0.0009	0.8198	0.0004	0.5553	0.0005	0.7669	0.0009	0.7140
t–3	0.0000	0.2644	–0.0016	–1.5602	–0.0007	–0.7669	–0.0010	–1.1635	–0.0005	–0.2644	–0.0012	–1.2429	–0.0008	–1.0842	–0.0009	–0.4496
t–2	–0.0004	–0.1322	0.0005	0.6611	0.0002	0.3173	0.0000	0.1587	–0.0006	–0.5289	0.0008	0.9784	0.0000	–0.0793	0.0002	0.3438
t–1	0.0015	0.9520	–0.0002	–0.2116	0.0014	1.0049	–0.0002	0.0000	0.0009	0.7933	0.0003	0.4760	–0.0006	–0.8727	0.0019	1.1371
t	–0.0027	–1.4809	0.0029	1.6924*	–0.0006	–0.5289	0.0008	0.9784	–0.0013	–0.9784	0.0015	1.4544	0.0024	1.7189*	–0.0022	–1.2958
t+1	0.0041	1.6660*	–0.0018	–1.5867	0.0032	1.6924*	–0.0005	–0.3173	0.0030	1.6395*	–0.0006	–0.6082	0.0000	0.0529	0.0024	1.2693
t+2	–0.0027	–1.4544	0.0031	1.7189*	0.0004	0.5289	0.0003	0.3967	–0.0006	–0.3702	0.0010	1.1900	–0.0003	–0.3967	0.0008	0.6347
t+3	0.0009	0.7669	–0.0021	–1.6531*	0.0018	1.1371	–0.0029	–1.6924*	0.0017	1.0842	–0.0028	–1.6395*	–0.0009	–1.2164	–0.0003	–0.1058
t+4	–0.0001	0.1587	0.0000	0.1322	–0.0006	–0.6347	0.0006	0.8727	–0.0006	–0.4231	0.0005	0.6611	0.0006	1.0313	–0.0007	–0.3702
t+5	–0.0031	–1.5338	–0.0029	–1.6924*	–0.0025	–1.5867	–0.0037	–1.7189*	–0.0020	–1.4015	–0.0040	–1.7189*	–0.0008	–1.1635	–0.0051	–1.6924*

Note: Table reports the results of the rank-based robustness test applied to the abnormal return series of the High- and Low-ESG portfolios and the Environmental €, Social (S), Governance (G), and ESG Controversies portfolios. AR stands for abnormal returns, H stands for high and L stands for low. Rank test evaluates whether abnormal returns observed during the event window are unusually high or low relative to the estimation period. * indicates statistical significance at the 10% level (two-sided test).

Source: Authors' calculations.

T a b l e A7
Daily AR Differences in 11-day Window

Portfolio	Mean difference (High-Low AR)	t-statistic	p-value
ESG	–0.002416	–1.378	0.198
E	0.000039	0.038	0.970
S	0.001298	2.214	0.051*
G	0.000454	0.668	0.519
Controversy	0.000305	0.438	0.671

Note: For each portfolio dimension, the table shows the mean AR difference, t-statistic, and p-value across the 11-day window. * denote significance at the 10% level.

Source: Authors' calculations.

T a b l e A8
Difference-in-CARs Tests

Portfolio	Event window	ΔCAR	t-statistic	p-value
ESG	[–1,+1]	–0.009184	–0.734	0.539
ESG	[–2,+2]	–0.026122	–1.803	0.146
ESG	[–5,+5]	–0.026576	–1.378	0.198
E	[–1,+1]	0.002007	0.199	0.861
E	[–2,+2]	–0.004698	–0.423	0.694
E	[–5,+5]	0.000431	0.038	0.970
S	[–1,+1]	0.003832	0.878	0.472
S	[–2,+2]	0.004119	0.976	0.384
S	[–5,+5]	0.014279	2.214	0.051*
G	[–1,+1]	0.001438	0.254	0.823
G	[–2,+2]	–0.001644	–0.287	0.788
G	[–5,+5]	0.004994	0.668	0.519
Controversy	[–1,+1]	–0.000225	–0.032	0.977
Controversy	[–2,+2]	–0.001544	–0.240	0.822
Controversy	[–5,+5]	0.003360	0.438	0.671

Note: The table below presents ΔCAR (High minus Low), the corresponding *t*-statistics, and *p*-values for each event window

Source: Authors' calculations.