DOES IT PAY TO SCORE HIGH ON ESG: AN EVENT STUDY ON THE SWEDISH STOCK MARKET

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Abstract:

Using daily stock returns of publicly traded Swedish companies, this paper aims to evaluate the difference in return performance between high-rated and low-rated ESG stocks in light of two events – COVID-19 and the Russia-Ukraine War. The overall study is conducted using an event study analysis, wherein the Carhart 4-Factor Model is employed to predict expected returns throughout the event window. A baseline event window of 11 days is used to analyze results across our two events. The outcome reveals that high- and low-rated ESG stocks did not perform differently around the declaration of COVID-19 as a pandemic by WHO. On the other hand, high-rated ESG stocks outperformed their low-rated peers during the 2022 Russian invasion of Ukraine. Our results are robust to alternative event windows.

Keywords:

Stock market performance, ESG rating, Sweden, COVID-19, Russia-Ukraine War

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List of Abbreviations

AAR	Average Abnormal Return
ALL	All stocks (both rated and non-rated)
AR	Abnormal Return
CAAR	Cumulative Average Abnormal Return
CAR	Cumulative Abnormal Return
CSR	Corporate Social Responsibility
ESG-DIFF	Difference between high-rated and low-rated ESG stocks
EV1	Event 1
EV2	Event 2
EXP	Exposure to Russia/Ukraine
FF3	Fama-French 3-Factor Model
FF4	Carhart 4-Factor Model
FF5	Fama-French 5-Factor Model
H_ESG	High-rated ESG stocks
L_ESG	Low-rated ESG stocks

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1. Introduction

1.1. Background

The topic of ESG and the inclusion of this factor in the assessment process of stock performance or investment success, in general, has gained traction in media and research literature in recent years. The term "ESG" itself is pretty new and was first brought to attention by the United Nations Environment Programme Finance Initiative in 2005. It aimed to denote companies' environmental, social and governance strategies to create longstanding value for the firm itself and society. Nowadays, an estimated 80% of companies worldwide release sustainability-related reports (KPMG Impact, 2020) and numerous agencies such as MSCI, Morningstar, and Refinitiv Eikon provide ESG-related ratings. To add another layer, pivotal events like the Global Financial Crisis, the COVID-19 pandemic and the 2022 Russian invasion of Ukraine have shaken markets considerably, therefore shedding more interest on stock performance in times of financial distress. The intersection of the two issues is particularly curious, as it has become a matter of economic and governmental policies (ASD, 2022).

In this paper, we aim to address whether high-rated ESG stocks performed better than low-rated ESG stocks in times of major events induced by "black swan" crises. We will focus on the performance of Swedish stocks through the lens of their ESG ratings. Unlike the one event approach that existing literature primarily focuses on, our paper conducts an event study analysis using two events:

1. The declaration of COVID-19 as a pandemic by the World Health Organization on March 11th, 2020;
2. The Russian invasion of Ukraine as an escalation of the Russo-Ukrainian War on February 24th, 2022.

1.2. Motivation

An inevitable question emerges upon establishing the scope of our research. What makes the declaration of COVID-19 as a pandemic and the Russian invasion of Ukraine relevant for our study in the context of ESG? We now attempt to provide a clear reasoning behind

our decision to employ these 2 events to conduct our analysis using a sample of Swedish publicly traded companies.

We choose two global events based on three important criteria, keeping in mind the new rise of interest in sustainability-related matters. First, the event should be induced by a "black swan" crisis; second, it should be relatively recent; third, the existing literature pertaining to the event should not be oversaturated. The Great Financial Crisis, although a "black swan" event, would not necessarily be a good candidate for our choice since it's a relatively old event in terms of ESG topicality, and the research on this economic downturn is oversaturated. On the other hand, the COVID-19 pandemic, as well as the Russian invasion of Ukraine fit all three criteria. Both events are "black swan" events given the sheer negative disruption they caused across global markets.

According to Agnew et al. (2022), between 2005-2018, ESG was rarely brought up (less than 1% of the time) during earnings calls. The situation looks completely different in 2021, where 20% of all earnings calls touch upon ESG. This fact reflects upon the novelty of these events with regard to ESG information. In terms of the third criterion, oversaturation might come across as a concern for COVID-19. But even though we have adequate existing literature on COVID-19, it doesn't delve deep into our topic of interest in our preferred geography, i.e., Sweden. The Russia-Ukraine War's full-scale impact is yet to be determined and so, the research on this event is premature. For this event, ESG-oriented research is particularly scarce.

Our two events are very current and pertinent to the present economic and market landscape. The Russia-Ukraine War did not only cause an energy crisis across Europe but also had far-reaching humanitarian and socio-economic repercussions. To a great extent, it sheds light on how the assessment of ESG risk needs to be redefined. Events like COVID-19 and the Russia-Ukraine War are generally considered to reshape the scope of ESG. A proof of the changing ESG dynamic is encapsulated in the fact that the rating agency Sustainalytics decided to update its methodology post the occurrence of these events.

Following the pandemic, Sustainalytics incorporated a new COVID-19 assessment model to upgrade the Country Risk Ratings (Sustainalytics, 2020). They

formulated a quantitative model that gauged the exposure and response of countries to the pandemic. Post the Russian invasion of Ukraine, the agency not only captured the country risk changes but also the systematic impacts on companies affected during the war (Sustainalytics, 2022). Sustainalytics' rationale[1] behind updating its methodology falls in line with our motivation to perform this study.

Although we don't use ESG ratings provided by Sustainalytics in our research, we presume that other rating agencies will follow and revise their methodologies as well. This would make it interesting to analyze whether current ESG scores manage to capture any significant performance disparity. The fact that these events have led to a change, not in the scores but in the methodology itself, prompts us towards the exponentially increasing importance of ESG. This helps explain the importance of such "black swan" events in the context of ESG and, increasingly, of companies affected by changes in ESG.

The impact of these events is not just limited to the recalibration of ESG as a concept. It has gone one step further to also alter the ESG investment landscape. Prior to the war, funds would follow the trend of divesting from industries deemed as unacceptable from an ESG perspective (e.g., the Norwegian pension fund KLP, a majority of pension funds in Switzerland) (Investment Monitor, 2022a). One example of such an industry would be arms production, the outlook on which has shifted since the start of the war. The increase in the defense budget of some countries and easing investment regulations in this sector, following the Russian invasion of Ukraine (Investment Monitor, 2022b) has an inevitable effect on the stock market and the investment landscape.

In Sweden, for example, SEB Investment Management has decided to review its guidelines for "admissible for investment" industries by including defense as one of them (SEB Group, 2022). This is also especially curious and relevant in the current geopolitical context, as Sweden has recently submitted its candidacy for NATO membership post Russia's invasion of Ukraine. In conclusion, these "black swan" events drive the

[1] On the decision to update the ESG score methodology following the outbreak of COVID-19, Sustainalytics (a Morningstar Company) stated: "All three capitals of a country, Human Capital, Natural & Produced Capital, and Institutional Capital, that we evaluate within our Country Risk Ratings are affected by the crisis." (Sustainalytics, 2020). Similarly, following Russia's invasion of Ukraine, Sustainalytics explained: "Taking the Russia-Ukraine conflict into account in the SG Risk Ratings poses a methodological challenge since ratings are typically constructed as stable systems that work under 'normal' conditions. […] Typically, the situation evolves rapidly, and assessments need to be regularly monitored and adjusted in accordance with the current state." (Sustainalytics, 2022)

repositioning of ESG from a static to a dynamic concept. Because we are currently standing at the cusp of this shift, it seems all-the-more relevant to contribute now to the existing research in this field.

Kick and Rottmann (2022) nudge us to question whether investing in firms with high ESG ratings could provide a shield against the downward risk during "black swan" events. While some studies in the U.S. show that firms with a higher sustainability rating benefited more than those with a lower rating during the Great Financial Crisis (Lins et al., 2017), others yield no such results for COVID-19. This discrepancy in outcome for different events does not exactly lead us to a definite conclusion. Thus, we are motivated to perform a study which attempts to find if investing in higher-rated stocks could act as a potential hedge during times of market distress. We will be testing this for our geography of interest, by standardizing the methodology for two recent "black swan" events.

As also inferred by Kick and Rottmann (2022), ESG-oriented stocks tend to perform differently during major critical situations (as well as during different timelines within the same event). They attribute this conclusion to a few potential explanations. Firstly, different events have a differing impact on stock performance because of dissimilarities in their nature. This served as a strong motivation for us to pick two fundamentally distinct events – the COVID-19 crisis, which is a public health emergency, and the Russia-Ukraine War, which is a geopolitical one. Thus, we want to determine whether the conclusions we draw for the first event would hold true for the second one in an identical geographical setup.

We use an event study approach to find whether high-rated ESG stocks overperform compared to their low-rated counterparts during the two events under consideration. While we observe no evidence of overperformance during WHO's announcement, we discover that during Russia's invasion of Ukraine a higher ESG-rating resulted in better returns for shareholders. We suspect that this outcome could be attributed to the previously mentioned dissimilarity in the nature of the events. We elaborate further on this outcome in future sections and explore other potential explanations behind the discrepancy in our results.

Our research contributes to the existing body of literature in two primary forms. First, our paper tackles the effects and implications brought along by incorporating the ESG perspective into the analysis of stocks. Second, our research adds to the growing literature on the impact of "black swan" events like COVID-19 and the Russian invasion of Ukraine on stock markets. We employ a unique approach to analyze ESG-rated Swedish stocks at two points in time through the perspective of two major international crises. We are also standardizing the methodology across two differently natured events to obtain comparative results. To the best of our knowledge, research based on the combination of our (a) employed methodology, (b) selected events and (c) studied geography has not been performed before. In this manner, we hope that our study results will help investors, portfolio managers and shareholders understand better whether favoring high-rated ESG stocks during times of crisis helps them navigate away from a downturn in returns and mitigate portfolio risks.

The thesis is structured as follows. Section 2 summarizes the existing literature on the performance of ESG-oriented stocks (2.1), as well as provides an ESG perspective on the impact of COVID-19 (2.2) and the 2022 Russian invasion of Ukraine (2.3). Next, section 3 provides details about the data employed, mostly its sources and how it was compiled. Section 4 provides details about the event study methodology. Next, section 5 presents the empirical results of our study. We divide this section into three subsections: 5.1 takes the reader through the main results, 4.2 engages in a robustness check for the results obtained in 4.1, and 4.3 discusses the results. In section 5 we summarize our closing remarks and in section 6 we suggest potential further research ideas, using our work as a baseline.

2. Literature Review

In the past years, scholars have employed various methodologies and measures to determine how the incorporation of the 3 ESG pillars – environmental, social and governance - in a company's strategy and operations drives welfare on numerous levels. This section aims to summarize the relevant literature and highlight tangencies with our research topic to draw parallels with our findings.

The discussed literature proposes an inclination towards ESG having a positive effect on stock performance for global equities. This stands true for studies done during regular times, COVID-19, and the Russian invasion. But, with this study focusing on Swedish stocks, we are more susceptible to research focused on European markets (even though we take a global perspective into account). Papers focused on analyzing the impact one European markets during regular times suggest insignificance of ESG's role as a driver of market returns. A pertinent study for this region conducted by Engelhardt et al. (2021) suggests that ESG orientation does not necessarily induce overperformance in high-trust economies during COVID-19. The sample of high-trust economies taken in this paper also covers Sweden, which makes our results directly comparable. Research focused on Europe covering Russia's invasion of Ukraine left us without a definite conclusion. The pandemic is known to have caused a worldwide havoc, leaving almost no economy untouched. The Russian invasion of Ukraine is more recent and not a lot of literature is available to review. So, it is still too early to draw a precise conclusion.

One positive difference between the available research on COVID-19 and the 2022 Russian invasion of Ukraine is that the timeline employed in literature on the latter issue is generally more standardized across papers. The lack of a standard "main" event within the pandemic poses an issue regarding research comparability. On the other hand, in the case of papers addressing Russia's invasion of Ukraine, the event date is commonly accepted as February 24th 2022. One additional aspect causing a divergence of opinions could be that rating providers use different methodologies for ESG scores, as per Halbritter and Dorfleitner (2015). Appendix A presents a summary table of the literature review and the relevant ESG ratings. It is clear that, as expected, scholars use different

rating sources to conduct their research, further contributing to diminishing the degree of comparability between results.

For this purpose, we structure our literature review into three main subsections related to research that touches upon:

- the general performance of ESG-focused stocks,
- the impact of COVID-19 on stock performance – ESG perspective,
- and the impact of the 2022 Russian invasion of Ukraine on stock performance – ESG perspective.

2.1. Performance of ESG-focused stocks

From a bird's eye view, it appears that there is conflicting evidence on ESG's role in stock performance during normal times. While literature focusing on the global perspective and on some developed economies, such as the U.S. and Australia, indicates that a higher ESG focus causes stock overperformance, studies performed in the European context suggest a generally insignificant stock performance. Since our geography of interest is Sweden, we are biased towards the latter.

Kumar et al. (2016) take a global perspective on analyzing how companies' incorporation of ESG factors into their businesses helps them adjust risk performance compared to their non-ESG counterparts. The authors discovered that more sustainable companies achieve better returns, and less volatility in stock performance. Verheyden et al. (2016) analyzed 23 developed and 23 emerging markets and established that using ESG factors in the screening process does indeed help minimize the tail risk and improve risk-adjusted returns. Upon reviewing literature for Europe, we encounter evidence of an insignificant difference between the performance of ESG and non-ESG stocks across European markets. Milonas et al. (2022) analyzed the performance of 64 U.S. and 80 European funds. They determined that the funds committed to investing in ESG-oriented stocks do not display any critical difference in returns compared to their non-ESG-oriented counterparts. La Torre et al. (2020) analyzed Eurozone companies included in Eurostoxx50 from 2010-2018 using both qualitative and quantitative ESG measures. They concluded that a sustainability focus was merely beneficial, except for a few companies that primarily operate in the energy and utility business.

The proof for the U.K. leans more towards a better performance from non-ESG stocks. Brammer et al. (2006) conclude that firms with higher social and environmental scores faced decreased returns, while those with lower scores exceeded the market return. This could be a consequence of the costs these companies incur due to their sustainability policies that shareholders, in turn, must bear. Luo (2022) reached the same results. The results for the U.S. stocks look more promising. As mentioned earlier, Lins et al. (2017) concluded that the stock returns of firms employing CSR strategies more actively benefited on average by 4-7% compared to their peers during the Global Financial Crisis.

A similar outcome was found by Galema et al. (2008) and Eccles et al. (2012). While the former established a more substantial effect for companies with a strong stance on the environment, product and diversity, the latter determined a more potent effect in the case of companies for which reputation was vital, as well as for companies operating in the business of natural resource extraction. In terms of long-term value, Glossner (2017) also finds that the higher the ESG risks a firm faces, the more decreased its stock returns are. Contrarily, by employing the Carhart four-factor model and the cross-sectional Fama-Macbeth analysis, Halbritter and Dorfleitner (2015) find no compelling evidence of discrepancies in stock returns between high-rated and low-rated ESG stocks[2]. Limkriangkrai et al. (2017) study Australian firms and conclude that there does not seem to be any effect on returns generated by higher ESG scores once these returns are adjusted for the Fama-French-Carhart risk factors.

2.2. Impact of COVID-19 on stock performance – ESG perspective

Overall, the existing literature gives evidence that higher ESG inclined stocks displayed overperformance during COVID-19. But the timeline and impact of these events varies considerably across papers and geographies, which makes it challenging to infer an overall conclusion about the impact of COVID-19 on financial markets. This matter is also raised by Martins and Cro (2022) in their paper. Even the key developments that scholars analyze in their research can be very different (e.g., the declaration of the outbreak as a Public Health Emergency of International Concern on January 30th 2020,

[2] This finding is also supported by Becchetti and Ciciretti (2006), who determine that socially responsible stocks tend to perform worse than their peers upon adding industry controls.

the declaration of the outbreak as a pandemic on March 11th 2020, lockdown announcements in different countries, announcements of vaccine effectiveness).

On a global level, our research helps us deduce that higher ESG inclination led to improved stock performance compared to a lower inclination during COVID-19. Ding et al. (2021) studied the relationship between ESG and stock returns through the prism of confirmed COVID-19 cases across 61 economies. The authors concluded that companies with a better score faced a smaller decrease in stock returns. Omura et al. (2021) applied MSCI ratings to study the performance of ESG equity investments in the U.S., Japan, and Europe, for 2,5 years, starting from January 2018. Their research confirms that these investments demonstrate a better performance than traditional investments during the COVID-19 pandemic. Ferriani and Natoli (2021) analyzed whether funds with a predisposition towards low-ESG-risk stocks gave superior returns during the pandemic. They found that these funds actually showed a more favorable performance. On the flip side, ESG ETFs did not show improved performance of ESG oriented stocks compared to their counterparts (Pavlova & de Boyrie, 2022).

Digging into Europe, Engelhardt et al. (2021) employed Refinitiv's ESG ratings to study the connection between these scores and stock performance throughout the COVID-19 breakout across 16 European markets. The paper finds that ESG generally plays a more central role in low-trust countries that do not exhibit strong regulation or rigorous disclosure standards. The outcome allocates no such significance to ESG for the sample of high-trust economies, which Sweden is a part of. This finding will be a pivotal point of comparison in the context of our research for the first event. Cardillo et al. (2022) provide evidence that although higher ESG-rated stocks showed better performance, sustainability was not necessarily the deciding factor, and general solid financial principles should also be taken into account.

Moving on to the U.S. market, Frambo and Kok (2022) studied the performance of stocks during the 2020 stock market crash in relation to their Sustainalytics ESG risk index score. The authors deduce that, in general terms, a smaller risk score determines better performance. Garel and Petit-Romec (2021) analyzed the environmental aspect of Thomson Reuters Asset4 scores across U.S. stocks. They determined that companies that emphasize environmental policies have gained better stock returns during the COVID-19

breakout. Not only did COVID-19 not shift investors' focus away from these matters, but it also made them more conscious of its importance. Consequently, markets reacted by compensating more for environmental awareness.

For the Asian markets, Broadstock et al. (2021) analyze the function of ESG factors in the COVID-19 recession in China. They deduce that ESG-oriented portfolios performed better compared to non-ESG-oriented ones. Additionally, they determined that the difference in performance between the two would not be as drastic during "regular" times, accentuating the significance of ESG in times of financial distress. The Korean market has been addressed in this context by Lee et al. (2022). Their study states that non-CSR companies are generally perceived as more volatile and riskier, leading investors to wind up their positions faster during a crisis. Takahashi and Yamada (2021) present an opposite outlook in the case of Japan. To determine what characteristics impacted the Nippon market throughout the coronavirus pandemic, the authors established a lack of relationship between companies that rank high according to Refinitiv ESG scores and abnormal returns.

2.3. Impact of Russia's invasion of Ukraine on stock performance – ESG perspective

Because the 2022 Russian invasion of Ukraine is relatively recent and still ongoing, the available literature, which is limited, mainly focuses on its overall impact on financial markets. Boubaker et al. (2022) say that Russia's war negatively impacted global financial markets, except for those of Middle East and Africa, pan-America, and Asia[3]. Their sample also includes Sweden's OMXS–30, the results for which show a strongly significant, negative performance of around 2,5% following the event. Moreover, research on this event from an ESG point of view is even more scarce. But unlike COVID-19, this event is cleaner as the event date is commonly taken as February 24th, 2022.

Basnet et al. (2022) studied the impact on 299 companies globally that chose to either stay or leave the Russian market following the invasion. Because companies that enjoy higher Refinitiv ESG scores are more inclined to leave the Russian market, the

[3] Yousaf et al. (2022) support this conclusion.

authors conclude that these firms met a weaker adverse market response compared to what low ESG-rated companies would have faced, had they announced ceasing operation. Kick and Rottmann (2022) present an opposing view. Conducting an event study across 15 developed European economies, the authors conclude that although ESG-oriented companies might benefit from the risk protection strategy offered by ESG loading in times of crises, the Russian invasion of Ukraine is not part of these crises.

Some of the concerns this event brought include skyrocketing oil and gas prices and a high energy risk (Investment Officer, 2022). We should note that Swedish imports of Russian energy resources include 8% of crude oil and 30% of liquefied natural gas (Library of Congress, 2022). This vulnerability to conventional energy presents an opportunity to shift to clean energy. Additionally, renewables present a potential goldmine since the Swedish government aims at a 100% transition to renewable electricity by 2040, with a 100% transition to a renewable energy system not out of the question either (Zhong et al., 2021).

Since the concept of renewable energy is such a topical one, particularly in Sweden's context, we direct our attention to clean and renewable energy markets. Umar et al. (2022) analyzed the energy and metal sectors for various global indices and deduced that renewable energy was the first to exhibit a spike in abnormal returns, seconded by conventional energy stocks. The second conclusion was that European markets showed the highest significant results compared to other global markets, mostly because the former were the first ones to be hit by the energy crisis. We can corroborate these findings with those of Nerlinger and Utz (2022), who did a similar study on Europe, North America, and Asia. This is an indicator that a higher dependence of European countries on Russian energy calls for a swifter transition to clean energy. These findings shed spotlight on an important consideration, which is to see if energy stocks drive the results for Event 2.

3. Data Sources and Compilation

With this paper, we try to find evidence whether Swedish stocks with a higher ESG rating differ in performance to their low-rated counterparts during global shocks. To find the events' impact on Swedish securities categorized according to their ESG ratings, we found it imperative to scout through three primary databases – Refinitiv Datastream, Refinitiv Eikon and the Kenneth French Data Library. From Datastream, we downloaded the stock prices of all Swedish securities and the benchmark index – OMX Affarsvarldens General Price Index – from mid-2019 to mid-2022. This data frame was chosen keeping in mind the occurrence of Event 1 in March 2020 and Event 2 in February 2022. Next, we downloaded the ESG ratings for Swedish firms from Refinitiv's Eikon database[4]. To run our prediction models, we picked Fama-French Factors for the relevant dates from Kenneth French's Data Library (2022). We downloaded daily factors for size, value, profitability, investment, and momentum for Europe.

After collecting all the appropriate data, we calculated daily returns for all securities and the index using the formula:

$$R_{it} = (P_{it} - P_{it-1}) / P_{it-1} \quad (1)$$

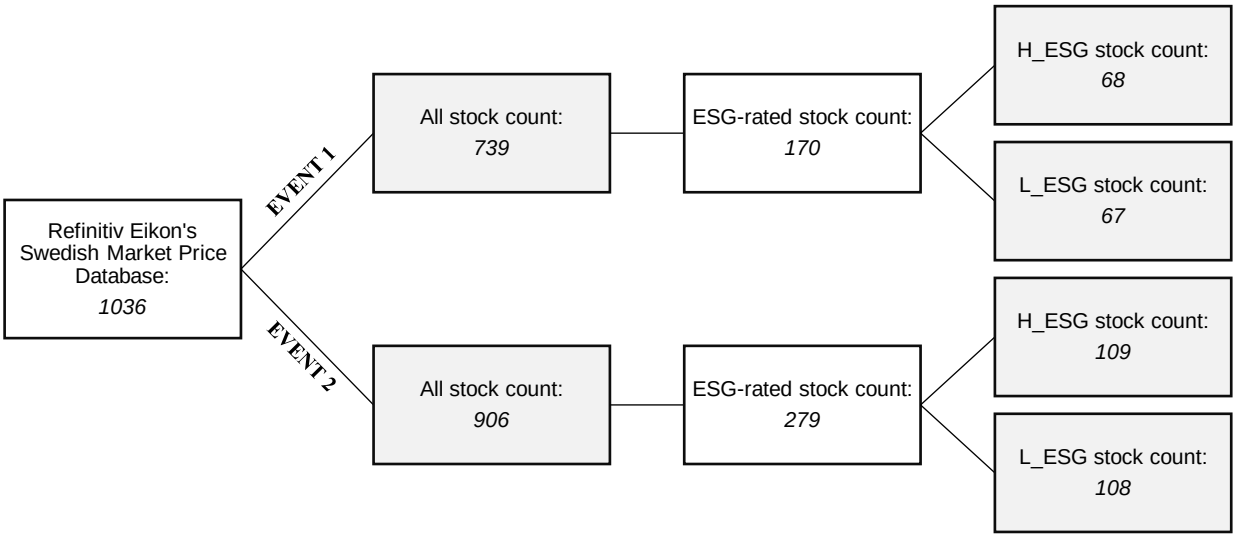
where P_{it} is the price of a security/index *i* on day *t* and P_{it-1} shows the price of a security/index i on day t-1.

We then accumulate two different data sets for our two events (Figure 1). First, market prices for 1036 stocks were downloaded from Datastream, but not all had ESG rating information available. Then, adjustments pertaining to different share classes, data unavailability and missing data left us with 739 securities for the first event and 906 securities for the second one. Event 2 has a higher all-stock count, as some stocks started trading after Event 1. This group forms our first category of interest – all stocks (*ALL*). Please note that *ALL* contains both ESG rated and non-rated stocks. We now move to

[4] We chose to pick ESG rating information from Refinitiv as it provided comprehensive rating information on Swedish stocks as well as the methodology applied behind those ratings. The database encapsulates and calculates over 630 company-level ESG indicators. From this, a subset of 186 of the most essential and comparable indicators per industry is used in the overall scoring process. The next step is to group this subset into ten different categories, which power the three main categories – Environment, Social and Governance (Refinitiv, 2022).

ESG-rated stocks for both our events to reach our ultimate variable of interest, which will help us answer the research question. First, we filter ESG-rated stocks for 2019, as per the methodology used by Takahashi and Yamada (2021) and get 170 stocks for Event 1. The count sums up to 279 ESG-rated stocks as of 2021 for Event 2. Then, we assign each dataset to two buckets – high-rated ESG stocks (*H_ESG*) and low-rated ESG stocks (*L_ESG*). While the former includes firms with an ESG score above the 60th percentile, the latter has those with an ESG rating below the 40th percentile. The difference between *H_ESG* and *L_ESG*, which we label "*ESG_DIFF*", will help us analyze how much better/worse off high-rated ESG stocks were, if at all, in comparison to low-rated ESG stocks.

Figure 1. Data Sorting and Filtering



4. Methodology – Empirical Approach

The event study methodology followed in this paper is in line with the one employed by MacKinlay (1997). Firstly, it is crucial to define the event day, estimation window and event window for the events under discussion.

4.1. Event Day

τ is a time variable which can take different days within the estimation/event window. For the event day, $\tau = 0$. Our event day for the first event is March 11th 2020, the day WHO declared COVID-19 as a pandemic. Event 2 is deemed to have occurred on February 24th 2022, when Russia officially declared its decision to invade Ukraine.

4.2. Estimation and event window

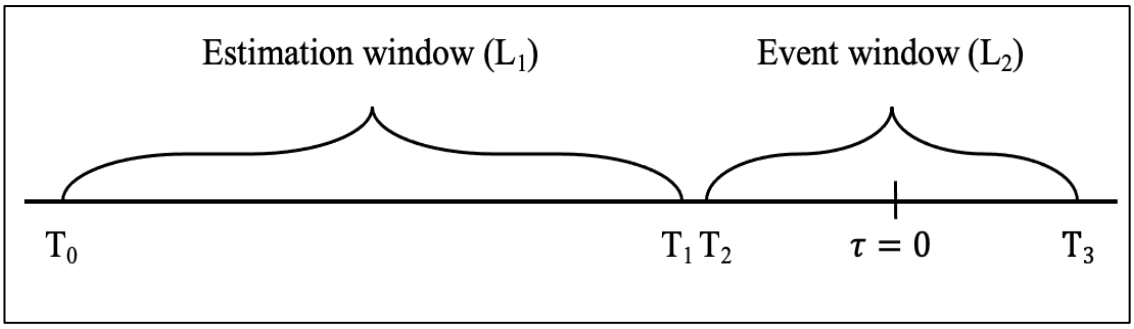
The estimation window is a period set before the event window and helps predict the normal (expected) returns for the latter, had the event not occurred. For both events, we take an estimation window of 120 days (denoted by L_1) that ends one day before the event window start date, T_1 (Figure 2). Brown and Warner (1985) and MacKinlay (1997) suggest 120 days as the estimation window period is sufficient to formulate a benchmark for normal returns. These 120 days include only trading days and end on *t-11*. Our baseline event window for abnormal return testing will be [-5, +5] days around the event date (denoted by L_2) to capture the immediate market reactions. T_2 denotes the event window start date, and T_3 denotes the event window stop date. To consider the far-reaching impact of our events and how they transpired over a longer time horizon, we also conduct our analysis on [0,0], [-10, +10], [-10, -6], [+6, +10].

Due to the fundamental nature of the events in our paper, it can be challenging to single out a precise date that might have impacted the market. For instance, before WHO declared COVID-19 a pandemic, the virus had spread to 28 countries outside of China by February 21st and 47 confirmed cases of COVID-19 were found in the European region (Ke et al., 2020). Sweden also started witnessing the impact the week after. In the case of Event 2, although the war was officially declared on February 24th 2022, it was already being anticipated by major world powers for more than a fortnight (Bown, 2022). To overcome this limitation, Miyajima & Yafeh (2007) consider the effect of the event

over several trading days and employ a baseline event window of [-5, +5]. This is in line with our methodology for event window selection. An event window incorporating some days before the event helps capture the effect of the likelihood of the event happening. It is important to help gauge a full picture of the market's reaction to the event.

One might argue why we did not choose the onset of COVID-19 in Sweden as our event day, which fell on February 26th 2020. But it should be noted that under the longer event window [-10, +10] (which we employ as a robustness check), this date is marked by *t-10*. So, the results for the [-10, +10] event window can be considered to make conclusions if February 26th 2020 is deemed as the main event day. Still, we stick to our methodology to deploy WHO's announcement as our primary choice of Event 1 for Sweden. This is because of the global reach of this announcement and the fact that a majority of the papers employ this date as the main event. So, even though a lot of different developments are used, the validity of the results under each of these developments stands in analyzing the impact of COVID-19.

Figure 2. Event timeline



4.3. Abnormal Returns and Cumulative Abnormal Returns

For each firm, we start by finding the Abnormal Returns ($AR_{i\tau}$) for each security *i* at time τ, as shown in the equation below:

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}) \quad (2)$$

where $R_{i\tau}$ is the actual excess daily return of the security and $E(R_{i\tau})$ is the normal/expected excess daily return of the security i on day τ obtained using the prediction model. The

following equation represents the baseline model (3) to the fitted model used for predicting returns (4):

$$R_{i\tau} = \alpha_i + \Sigma_k \beta_{ki} f_{k\tau} + \epsilon_{i\tau} \quad (3)$$

The fitted regression for calculating expected returns under different factor models looks as follows:

$$E(R_{i\tau}) = \hat{\alpha}_i + \Sigma_k \hat{\beta}_{ki} f_{k\tau} \quad (4)$$

where *k* is the total number of factors; *f* represents the factors used in this study – EMR, SMB, HML, RMW, CMA, WML, which stand for excess market return, size, value, profitability, investment and momentum, respectively (Shanaev & Ghimire, 2022). Refer to Appendix B for the expanded version of the factor models.

The excess stock/market returns are calculated as the difference between stock/market return on a particular day and the 1-month Swedish Treasury Bill rate obtained from the Swedish Riksbank website (Sveriges Riksbank, 2022). The next step is to understand the computation of Cumulative Abnormal Returns (CARs), as shown in equation 5, for security *i* for all τ over the event window L_2. In simple terms, Cumulative Abnormal Returns sum up the abnormal returns for a security for the event window.

$$CAR_i(T_2, T_3) = \sum_{\tau=T2}^{T3} AR_{i\tau} \quad (5)$$

4.4. Average Abnormal Returns and Cumulative Average Abnormal Returns

To gauge the comprehensive reaction of Swedish stocks to the events of interest, we determine the Average Abnormal Returns (AARs), which are the averages of the abnormal returns of all securities on each day.

$$AAR_\tau = \frac{1}{N} \sum_{i=1}^{N} AR_{i\tau} \quad (6)$$

where AAR_τ shows the average abnormal return across all securities on day τ and *"N"* is the number of securities[5]. Then, we calculate Cumulative Average Abnormal Returns (CAARs) for the event window using AARs.

$$CAAR_\tau(T_2, T_3) = \sum_{\tau = T2}^{T3} AAR_\tau \quad (7)$$

where $CAAR_\tau$ takes the sum of AAR for all τ over the event window L_2 (T_2 to T_3). This helps us understand the event's combined impact across all securities at different points in the event window.

The main object of our study is to analyze CAARs for the event window(s) to see if the null hypothesis can be refuted or not for each event. Since the aim of this thesis is to analyze the difference in results for *H_ESG* and *L_ESG* categories, we restrict the scope of this paper to analyze one main hypothesis for each event, the null for which can be stated as:

> **H0:** The difference in cumulative average abnormal returns (CAARs) for high-rated ESG firms and low-rated ESG firms is not statistically different from 0 in Sweden for the main event window [-5, +5].

The hypothesis for each event, will be tested across additional event windows to ensure the robustness of our results.

4.5. Testing significance of AARs and CAARs

To test the statistical significance of AARs and CAARs, we deploy the t-statistic as has been done by many event studies (e.g., Barber & Lyon, 1996; Brown & Warner, 1985). In addition, we use the t-test to test our null hypothesis, as the distribution of the abnormal returns during the event window for a given security is normal, as below:

$$AR_{i\tau} \sim N(0, \sigma^2(AR_{i\tau})) \quad (10)$$

For *ESG_DIFF*, we performed a two-sample t-test to analyze the significance of AAR and CAAR metrics. The standard errors employed are robust[6].

[5] We employ equal weights here, as per the standard event study methodology.
[6] Adjusted for heteroskedasticity.

4.6. Model selection

A robust model is needed to predict normal returns during the event window. The reason behind choosing one fundamental prediction model is to accommodate for easy presentation and discussion of results throughout this paper and to use the rest of the models as a robustness check (Appendix C). We decided to set Carhart 4-Factor (FF4) model (Carhart, 1997) as our base model because it gave a high explanatory power and more statistically significant metrics. Additionally, we suspect the presence of the momentum factor in the estimation window for both events.

For Event 1, we set our event date in March 2020, but COVID-19 started to root itself already back in January of the same year. It could also be argued that COVID-19 took base in Europe at the end of February, when Sweden started seeing its impact. For Event 2, we set the event date at the end of February 2022. The estimation window for this event could be contaminated due to the presence of the Omicron variant of COVID-19 in January and speculation of the occurrence of Russia's invasion in February.

Hereafter, we will primarily be discussing the results considering this model.

5. Empirical Results and Discussion

5.1. Main Results

5.1.1. Event 1

Table 1 presents the results for our baseline event window, [-5, +5]. An insignificant CAAR for the window, as witnessed on *t+5*, provides evidence against rejecting the null hypothesis. Therefore, we lack proof to state that high-rated ESG stocks in Sweden over/under performed compared to low-rated ESG stocks for our event window. On the event day, *t*, the AAR for *ESG_DIFF* was also statistically insignificant. In the days following the event, the first three days give significant AAR values. But upon careful consideration, we realize that subsequent AARs are alternating between positive and negative values that seem to nullify each other's effect. Such volatility aligns with our earlier concern around the lack of a precise event date for COVID-19 due to its fundamental nature.

Table 1. AARs and CAARs for Event 1 for the 11-day event window

	ESG_DIFF	
Day	AAR	CAAR
t-5	-0,0067*	-0,0067*
t-4	0,0043	-0,0023
t-3	0,0006	-0,0018
t-2	0,0195***	0,0177*
t-1	-0,0044	0,0134
t	0,0019	0,0153
t+1	0,0310***	0,0463**
t+2	-0,0177**	0,0286
t+3	0,0247**	0,0533*
t+4	-0,0091	0,0442
t+5	0,0033	0,0475

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

5.1.2. Event 2

For Event 2, Table 2 displays the results for our baseline event window, [-5, +5]. The *t+5* CAAR of 4,3% is significant at the 5% level. This provides grounds for rejecting the null hypothesis to suggest that high-rated ESG stocks performed better than low-rated ESG

stocks in Sweden during Russia's invasion of Ukraine. On the event day, a significant AAR value of 1,6% further asserts our position in favor of rejecting the null hypothesis. From a first look, it might seem that our event window contains negative AAR values in support of a better performance of low-rated over high-rated ESG stocks. But, upon a closer look, all negative AARs, except for one, display insignificance.

Table 2. AARs and CAARs for Event 2 for the 11-day window

	ESG_DIFF	
Day	AAR	CAAR
t-5	0,0065	0,0065
t-4	0,0099***	0,0163***
t-3	0,0152***	0,0316***
t-2	-0,0035	0,0281***
t-1	-0,0032	0,0249**
t	0,0164**	0,0413***
t+1	-0,0116**	0,0297**
t+2	0,0015	0,0311**
t+3	-0,0026	0,0286*
t+4	0,0033	0,0319*
t+5	0,0111**	0,0430**

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

5.2. Robustness Check

To provide a more comprehensive analysis, Table 3 displays CAARs for our main, as well as for four additional event windows. The first CAAR for [0, 0] is actually the AAR for event day *t*. The next two CAARs display the results for a short and long event window to gauge the immediate and the extended impacts, respectively. These will not only help us compare how far the impact of an event lasted but will also aid in understanding whether an analysis of 10 additional days changes the magnitude of the impact significantly. Finally, the inclusion of the last two event windows helps eliminate the possibility of a contaminated event window and see if the impact of the event was limited to an immediate reaction around the event day (basically during the baseline event window).

A robustness check for Event 1 reconfirms our previous inference that the event induced no overperformance by high-rated ESG stocks. This holds true for all the different event windows that are analyzed. Even the event day CAAR[0, 0] does not exhibit significance. The longer event window, [-10, +10], confirms our outcome for the shorter window by displaying insignificant results as well.

In case of Event 2, we can deduce an opposite conclusion and reject the null hypothesis. CAAR values on the event day (1,6%), during the shorter window (4,3%) and the longer window (5,3%) show significance at 5% level. The impact of Event 2 stretches to the longer window, even though it is just around 1% higher in magnitude than the shorter window. Additionally, to see if the results for [-10, +10] window were mostly driven by [-5, +5], we check the CAARs for non-overlapping event windows, [-10, -6] and [+6, +10]. The CAAR values for the latter two windows are insignificant at all levels. This implies that the longer event window outcome is majorly driven by the shorter window. So, the effect of Event 2 looks clean and centered close to the event day.

Table 3. CAARs for different event windows

	Event 1	Event 2
CAAR[0, 0]	0,0019	0,0164**
CAAR[-5, +5]	0,0475	0,0430**
CAAR[-10, +10]	0,0566	0,0533**
CAAR[-10, -6]	0,0029	0,0111
CAAR[+6, +10]	0,0062	-0,0008

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

5.3. Discussion

Insignificance in CAAR for our baseline event window, [-5, +5], is strongly supported by the outcome of the robustness check for Event 1. Table 7 gives a summary of whether we can reject the null hypothesis under (a) our primary event window, [-5, +5] and (b) our additional event windows employed for the robustness check. **Thus, we fail to reject the null hypothesis and deduce that high-rated ESG securities in Sweden do not perform statistically differently than their low-rated counterparts around WHO's declaration of COVID-19 as a pandemic.** The conclusions we draw for Event 1 also align with those of Takahashi and Yamada (2021), as well as with those of Bae et

al. (2021) Even though they conduct their analyses on different geographies compared to our work (i.e., the U.S. and Japan), the results have direct tangencies to each other.

We now discuss some possible explanations in favor of our outcome. Firstly, the lack of evidence of better stock performance from high-rated ESG stocks could be attributable to our choice of event. COVID-19 was a health emergency, throughout the course of which there were several key developments, one of them being WHO's declaration. But our results suggest that this might not be a significant event for Sweden. It is difficult to determine a primary event that captures COVID-19 as the key developments varied in magnitude and timing across different geographies. Secondly, it is possible that the sheer scale of the market turmoil caused by the event might have affected companies without discriminating them based on their ESG ratings.

To see if our conjecture of a lack of bias between high and low-rated ESG stocks in Sweden during Event 1 holds true, we decided to extrapolate the CAARs for the *ALL* category (Table 6). We did this to see if the Swedish market, as a whole, reacted negatively during Event 1. The result of -11,0% CAAR for [-5, +5] and -13,6% for [-10, +10] were strongly significant at 1% level. So, the combined reaction of the market was negative around the event, providing further support to our suspicions of no bias in market's treatment of ESG-rated stocks. These results for the whole market also led us to question our earlier explanation around WHO's announcement not potentially being a significant event in Sweden. This is because if the announcement is assumed to not capture COVID-19 well, then a rational individual would not expect the market to show such drastic abnormal returns. This being said, we still hold the view that our explanation can be justified as WHO's announcement on March 11th aligned with the onset of COVID-19 in Sweden. So, it is possible that the market was still reacting to and sinking in this new concept of "COVID-19".

Our choice of Sweden as our geography of interest is tightly related to the fact that the country has recently ranked very highly in terms of ESG commitment. According to the RobecoSAM Country Sustainability Ranking, Sweden secured second place among 150 countries (Robeco, 2022). Therefore, another possible explanation behind the lack of difference in performance might be that the ESG component is already well incorporated and rewarded in Sweden. Moreover, since Sweden is a high trust economy, we can

reassert the conclusion derived by Engelhardt et al. (2021) that high-rated ESG firms from high-trust economies (the sample for which includes Sweden) seem to reap no benefits in terms of stock performance.

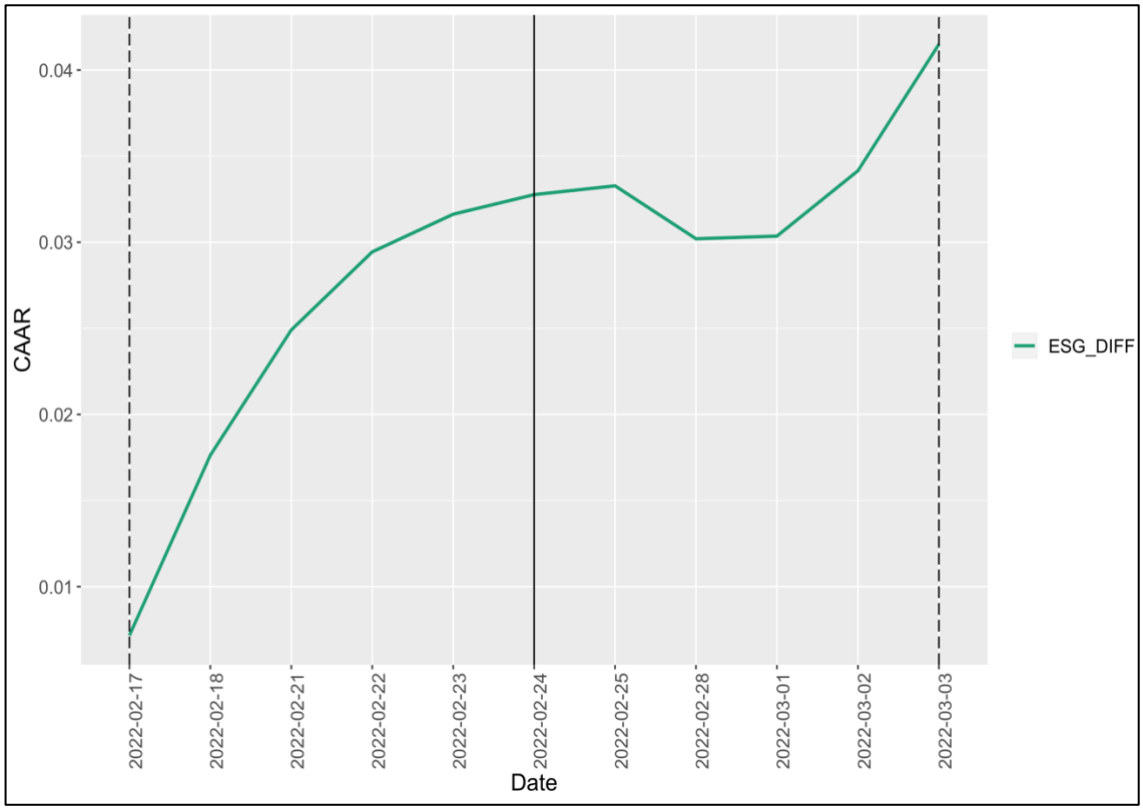
On the other hand, there is strong evidence of overperformance of high-rated ESG stocks for Event 2. CAAR for the main event window [-5, +5] exhibits significance, which is confirmed by the robustness check (Table 7). **Thus, we reject the null hypothesis and infer that high-rated ESG stocks in Sweden outperformed their low-rated counterparts around Russia's invasion of Ukraine.** Furthermore, as we deduced in the robustness check, the impact of this event was primarily concentrated around the shorter event window. The strongly significant AARs in the pre-event period for the baseline window seem to be driven by two major announcements. On February 18th 2022, as marked by *t-4*, U.S. President Joe Biden speculated about Russia declaring a war on Ukraine in the following week (White House, 2022). On February 21st 2022, as marked by *t-3*, Russian President Vladimir Putin recognized the independence of two separatist regions, the so-called "Donetsk People's Republic" and "Luhansk People's Republic". These two announcements, which anticipated the occurrence of Event 2, kickstarted the significance in CAAR.

The post event window AARs don't exhibit results in favor of higher rated stocks, except for the value on *t+5*. While we see significance on *t+1*, the AAR for this day is negative (-1,2%), indicating an upper hand for low-rated ESG stocks. The first instinct might be to ignore the average abnormal returns from *t+2* to *t+4*, as they are insignificant. But since AARs are mostly important in understanding the development of CAARs over the event window, we analyze these days primarily from the CAAR perspective. Additionally, towards the end of the post-event window, we can see a recovery in AAR. Since CAARs show significance for all days in the post event window, albeit a fluctuating one, the resulting CAAR for the whole window is significant. We can presume from these inferences that shareholders mostly showed their preference for better rated companies in the pre-event window and on the event day. In the post-event window, they still display preference, although a tempered one.

These results can be visually followed in Figure 3, which shows the CAAR trend line for *ESG_DIFF* for Event 2 during the primary event window [-5, +5]. We don't

show a similar graphical representation for Event 1, as our analysis yields statistically insignificant results for *ESG_DIFF*. The figure below shows an overall rising CAAR trend. The trend sees a steep upward rise in the pre-event period, with a slight downfall in the middle of the post event period. It is eventually driven up by the significant AAR on *t+5* to lead a statistically significant CAAR for the primary window.

Figure 3. *ESG_DIFF* CAAR[-5, +5] trend line for Event 2



To get a better understanding of what was driving our results, we decided to consider the exposure of firms in our sample to Russia/Ukraine[7]. No database gave out promising information on exposure, so we manually scouted annual and interim reports. Table 4 provides a stock count of high-rated (*H_ESG*) and low-rated (*L_ESG*) firms classified according to whether they were exposed to Russia/Ukraine (*EXP*) or not exposed (*NEXP*). We move to investigating whether there is a disparity in the performance of *ESG_DIFF* for exposed versus not exposed firms (Table 5).

[7] We primarily examine the revenue exposure of a company to Russia/Ukraine; we also checked for the mention of exposure to Russian/Ukrainian suppliers.

Our tests reveal that difference between *H_ESG* firms exposed to Russia/Ukraine and their *L_ESG* counterparts showed an insignificant result for the baseline window [-5, +5], as represented by the CAAR on *t+5*. We can see that CAAR values are significant only on three out of eleven days (*t-3, t-2,* and *t*), exhibiting weak and limited evidence of a better performance by high-rated, exposed ESG firms. On the other hand, among non-exposed firms, CAAR for *ESG_DIFF* is significant on six days, four of which lie in the pre-event period. CAAR for the whole window, [-5, +5], is not significant. All in all, we can see some proof of overperformance by *H_ESG* firms under both categories, but only in the pre-event period.

Table 4. Exposure to Russia/Ukraine: stock count

Category	EXP	NEXP	Total
H_ESG	56	53	109
L_ESG	38	70	108

Table 5. Exposure to Russia/Ukraine: 11-day event window CAARs

	ESG_DIFF	
Day	EXP	NEXP
t-5	0,0047	0,0062
t-4	0,0150	0,0148*
t-3	0,0284*	0,0280**
t-2	0,0269*	0,0247**
t-1	0,0239	0,0207*
t	0,0471**	0,0332**
t+1	0,0395	0,0222
t+2	0,0265	0,0338*
t+3	0,0226	0,0329
t+4	0,0360	0,0307
t+5	0,0605	0,0312

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

Two inferences can be drawn from this. First, there is some evidence of overperformance by high-rated ESG stocks for both exposure categories. Although, it is limited primarily to the pre-event period and seems more pronounced for non-exposed firms. Second, since event day CAAR jumps up and gains more significance, we can

deduce a relatively stronger performance on day *t*. Even this holds true for both the exposure categories. Additionally, both exposed and non-exposed *H_ESG* firms performed better compared to their *L_ESG* counterparts by an average of 3-4%. Thus, we conclude that exposure, in general, does not seem to play a role in driving the results for Event 2. We verify this conclusion in Appendix D by computing the difference in CAAR between *S_EXP* and *S_NEXP* for each category, where S = *L_ESG* or *H_ESG*.

There might be a pre-meditated notion that the low-rated ESG (*L_ESG*) category is composed of dirty stocks[8] and the high-rated (*H_ESG*) category is composed of clean energy stocks. Consequently, this might prompt the reader to think that the outcome for Event 2 might be driven by energy stocks that were directly affected by the war. The war caused an adverse impact on this sector and brought up dire effects of over-reliance on Russian energy. This caused a surge in conventional energy prices that benefitted dirty stocks and accentuated the need to shift to renewable energy. Our literature review touches upon how, during Event 2, the renewable energy sector outdid the conventional energy sector, although the latter is a close second in terms of positive performance. While these conclusions could have explained our Event 2 results, we cannot adopt them due to a lack of requisite ESG data on energy stocks. This is because when we check our sample, we found that only 5 energy stocks are rated among the *ESG_DIFF* firms[9].

Similarly to Event 1, the results from the *ALL* category showed strong negative results for Event 2 as well. CAAR for the primary event window was -2,3% and that for the [-10, +10] event window was -5,3%, both significant at 1% level (Table 6). But the difference in the case of Event 2 is that market's reaction displayed a bias towards differently rated ESG stocks. Even when we compare the magnitude of both our events, -11,0% for Event 1 compared to just -2,3% for Event 2, we can see that the market was reacting to the pandemic more harshly than it was to Russia's war. This could be because Event 1 induced a longer period of uncertainty with an acutely short sight of how far its impact might reach. On the other hand, although Event 2 gave rise to uncertainty as well, there were expectations that sanctions imposed by other countries will somehow coerce Russia to call off its war. So, for Event 1, shareholders seemed to have withdrawn their wealth from all stocks in Sweden without exhibiting favoritism for higher ESG rated

[8] We define "dirty stocks" as oil and gas stocks that are engaged in exploration and production.
[9] Refinitiv's Eikon database does not provide ratings for most energy stocks in our sample.

stocks. For Event 2, they seemed to have waited on pulling their money from these stocks. This appears to be the case even for an economy like Sweden, that has a relatively close geographical proximity to Russia/Ukraine.

Our findings show an evolution of the performance difference between high-rated ESG stocks and low-rated ESG stocks throughout the two events. We suspect that the biased performance of high-rated over low-rated ESG stocks can be linked to, but not directly be used to infer, a change in shareholder preference and reaction to "black swan" events between 2020 and 2022. This also helps us claim that high-rated ESG stocks could serve as a safety net during periods of market distress. Another potential explanation for the different results we get in the context of our two events could be that since one of the events – Russia's invasion of Ukraine – is newer and since ESG has gained significant traction more recently, companies have started to reflect their ESG strategies more accurately in their actions (Bae et al., 2021).

Moreover, Brammer et al. (2006) also mention that firms with higher ESG scores might not benefit from a sustainability focus as much since costs related to ESG activities ultimately offset the value created by them. We could therefore hypothesize that because high-rated ESG companies performed better during Event 2, this might mean that firms have learned to optimize their ESG-related spending. Additionally, since we mentioned previously in our paper that the methodologies employed by rating agencies are ever evolving, our results could also suggest that ESG scores have developed over recent years to capture companies' current ESG situation more efficiently and authentically.

Table 6. CAARs for all stocks (*ALL*) category for the short and long event windows

	Event 1	Event 2
CAAR[-5, +5]	-0,1102***	-0,0223***
CAAR[-10, +10]	-0,1359***	-0,0529***

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.

Table 7. Results for Hypothesis Testing

Null hypothesis (H_0)	Baseline Window	Robustness Check
The difference in CAAR for high-rated ESG firms and low-rated ESG firms was not statistically different from 0 in Sweden for Event 1.	Supported	Supported
The difference in CAAR for high-rated ESG firms and low-rated ESG firms was not statistically different from 0 in Sweden for Event 2.	Not Supported	Not Supported

6. Conclusion

This study set out to determine how the Swedish market's response to high-rated ESG companies differed from that to low-rated ESG companies in light of two events – the declaration of COVID-19 as a pandemic by WHO and Russia's invasion of Ukraine. For both events, we employed the event study approach as MacKinlay did in his 1997 paper. In addition, we used an estimation window of 120 days to serve as a base for forecasting the expected returns across the event window. The results from one key prediction model (Carhart 4-Factor Model) are evaluated over a baseline event window, [-5, +5]. We then perform a robustness check on this outcome to see whether the resulting inference holds for additional event windows.

The empirical results for Event 1 found no evidence of over/underperformance of high-rated ESG stocks compared to their low-rated peers. We suppose that the fundamental nature of the event could have played a part in shaping the outcome. The entire duration of this health emergency was marked by several developments, the impact of which might not be captured by our choice of event. Another potential conclusion that arises here is that the massive disruption caused by the pandemic did not allow the market to differentiate performance on grounds of ESG preference. Even if this ESG-led divergence existed, it becomes difficult to track when it might, if at all, have taken place. This is one of the limitations of our study.

For Event 2, our results indicate that high-rated firms were rewarded over their low-rated counterparts for better ESG performance. An important consideration is that energy stocks (clean or conventional) do not take up a significant chunk of ESG-rated stocks in this research. Thus, the overperformance of energy stocks, and clean energy stocks more so than conventional energy stocks, during Event 2 (Umar et al., 2022) does not hold any bias in the results obtained in this study. We also refrained from diving into industry-specific performance and limited the research in this paper to a generic level.

The second event witnessed a shift in outcome in favor of high-rated ESG stocks. This could be because shareholders did not display a bias in their reaction to differently rated ESG stocks during Event 1, but they did so for Event 2. During Event 1, the entire Swedish market fell by -11,0% and there were no signs of a bias towards the stocks with high ESG scores, as can be seen from the insignificant CAAR[-5, +5] of *ESG_DIFF*. But

for Event 2, while the whole market experienced a downfall (of around -2,3%), it exhibited a significant difference in its response to high-rated and low-rated ESG stocks.

The evolution in the difference in performance of ESG-rated stocks can also be attributed to other reasons. It could be a result of shareholders learning to incorporate high-rated ESG stocks to hedge their downward risk during times of market distress. The Global Financial Crisis, COVID-19, and Russia's invasion of Ukraine all disrupted economies, as well as company operations worldwide. These catastrophes affected global policymakers, investors, and firms, and incited a need to focus on ESG investing more actively (Díaz et al., 2021). This also emphasized the importance of good and steady governance during tumultuous periods. A similar idea is enforced by Broadstock et al., in their 2021 paper. Another explanation could be that companies struck a balance between the costs required to carry out ESG strategies and the benefits reaped as a result of their implementation.

7. Limitations and Further Research

We will conclude this thesis by listing the limitations and providing avenues for future research.

To reiterate, our choice of *WHO's announcement* as the event to represent COVID-19 in Sweden aligns with existing literature. However, there might be better suited events that would reflect the impact of COVID-19 on the Swedish market. This would require conducting event studies over different developments. This goes beyond the scope of our thesis and is one of the limitations of our study. If one is particularly interested in determining the said impact while considering a more extended timeline spanning over several months/years, a good alternative could be to use an interrupted time series analysis with an autoregressive integrated moving average (ARIMA) model. Another limitation of this study pertains to the manually collected database of company exposure to Russia/Ukraine. There was no standardized database available to us to account for the effect of exposure. Our database is a simplified version of what constitutes exposure and is vulnerable to human errors.

Many other databases provide ESG scores, but we exclusively limit ourselves to Refinitiv's Eikon database due to database access and our preference for its rating methodology. However, Since the rating methodology and criteria vary for different databases, it would be interesting to see if the outcome changes notably if another database is deployed. In the case of the Russian invasion of Ukraine, it would be particularly curious to employ scores provided by an agency that rates dirty and clean stocks since the energy sector is in the limelight following this event. As mentioned earlier, some rating agencies are changing their score assessment guidelines to capture the latest economic and geopolitical developments. Assuming that this methodological change has a material impact on scores, one could alternatively study the impact of the rating change on stock performance to deduce how well the new ratings reflect recent market trends.

We only compared the performance of stocks that belonged to different percentiles within the portfolio of Swedish ESG-rated firms. It would be interesting to focus on a research study that compares the performance of ESG-rated stocks to that of non-ESG-rated stocks in Sweden. Furthermore, this paper studies the effect on ESG-rated

stocks and does not delve into researching the impact of an event on stocks categorized by individual ESG pillar scores. This provides opportunities to test if a certain pillar score plays a more critical role, during major events, in stock performance than the others.

Next, we limited the number of "black swan" events in this thesis to 2. More events could be employed, and that too of different natures, to analyze if the results obtained from these two events were one-time outcomes. Lastly, we did not add an industry control as most industries were similarly represented in our H_ESG and L_ESG samples. A step further would be to conduct the study on a larger sample that includes other geographies besides Sweden. In this way, one could employ a country-fixed effect to determine whether a country's ESG commitment affects how low- versus high-rated ESG firms perform.

8. References

Agnew, H., Klasa, A., & Mundy, S. (2022). *How ESG investing came to a reckoning.* Retrieved on November 13th, 2022, from: https://www.ft.com/content/5ec1dfcf-eea3-42af-aea2-19d739ef8a55

Association for Supporting the SDGs for the United Nations (ASD) (2022). *Sustainable Development Goals.* Retrieved on November 8th, 2022, from http://asdun.org/?page_id=2528&lang=en

Bae, K.-H., El Ghoul, S., Gong, Z., & Guedhami, O. (2021). Does CSR matter in terms of crisis? Evidence from the COVID-19 pandemic. *Journal of Corporate Finance, 67*. https://doi.org/10.1016/j.jcorpfin.2020.101876

Barber, B. M., & Lyon, J. D. (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics 43*(3), 341-372. https://doi.org/10.1016/S0304-405X(96)00890-2

Basnet, A., Blomkvist, M., & Galariotis, E. (2022). The role of ESG in the decision to stay or leave the market of an invading country: The case of Russia. *Economic Letters, 216*. https://doi.org/10.1016/j.econlet.2022.110636

Becchetti, L., & Ciciretti, R. (2009). Corporate Social Responsibility and Stock Market Performance. *CEIS Working Paper No. 79.* http://dx.doi.org/10.2139/ssrn.897499

Boubaker, S., Goodell, J. W., Pandey, D. K., & Kumari, V. (2022). Heterogenous impacts of wars on global equity markets: Evidence from the invasion of Ukraine. *Finance Research Letters, 48.* https://doi.org/10.1016/j.frl.2022.102934

Bown, C. P. (2022). *Russia's war on Ukraine: A sanctions timeline.* Retrieved on November 16th, 2022, from https://www.piie.com/blogs/realtime-economics/russias-war-ukraine-sanctions-timeline

Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate Social Performance and Stock Returns: UK Evidence from Disaggregate Measures. *Financial Management, 35*(3), 97-116. https://doi.org/10.1111/j.1755-053X.2006.tb00149.x

Broadstock, D. C., Chan, K., Cheng, L. T. W., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters, 38.* https://doi.org/10.1016/j.frl.2020.101716

Brown, S.J. and Warner, J.B. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics, 14*(1), 3-31. http://dx.doi.org/10.1016/0304-405X(85)90042-X

Cardillo, G., Bendinelli, E., & Torluccio, G. (2022). COVID-19, ESG investing, and the resilience of more sustainable stocks: Evidence from European firms. *Business Strategy and the Environment,* 1-22. https://doi.org/10.1002/bse.3163

Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. *The Journal of Finance*, *52* (1), 57–82. https://doi.org/10.2307/2329556

Diaz, V., Ibrushi, D., & Zhao, J. (2021). Reconsidering systematic factors during the Covid-19 pandemic – The rising importance of ESG. *Finance Research Letters, 38*. https://doi.org/10.1016/j.frl.2020.101870

Ding, W., Levine, R., Lin, C., & Xie, W. (2021). Corporate immunity to the COVID-19 pandemic. *Journal of Financial Economics*, *141*(2), 802-830. https://doi.org/10.1016/j.jfineco.2021.03.005

Eccles, R. G., Ioannou, I., & Serafeim, G. (2012). The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance. *National Bureau of Economic Research, Working Paper No. 17950.* Retrieved on November 10th, 2022, from https://www.nber.org/system/files/working_papers/w17950/revisions/w17950.rev0.pdf

Engelhardt, N., Ekkenga, J., & Posch, P. (2021). ESG Ratings and Stock Performance during the COVID-19 Crisis. *Sustainability, 13*(13). https://doi.org/10.3390/su13137133

Ferriani, F. & Natoli, F. (2021). ESG risks in times of Covid-19. *Applied Economics Letters*, *28*(18), 1537-1541. https://doi.org/10.1080/13504851.2020.1830932

Frambo, M.B., & Kok, C.J. (2022). ESG Score, Stock Valuation, and Stock Performance during the 2020 COVID-19 Stock Market Crash. *The Journal of Impact and ESG Investing*, *2*(4), 69-77. https://doi.org/10.3905/jesg.2022.1.046

French K. R. (2022). *Data Library.* Retrieved on September, 23rd, 2022 from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Galema, R., Plantinga, A., & Scholtens, B. (2008). The stocks at stake: Return and risk in socially responsible investment. *Journal of Banking & Finance, 32*(12), 2646-2654. https://doi.org/10.1016/j.jbankfin.2008.06.002

Garel, A., & Petit-Romec, A. (2021). Investor rewards to environmental responsibility: Evidence from the COVID-19 crisis. *Journal of Corporate Finance, 68*. https://doi.org/10.1016/j.jcorpfin.2021.101948

Glossner, S. (2017). ESG Risks and the Cross-Section of Stock Returns. *Paris December 2017 Finance Meeting EUROFIDAI – AFFI.* http://dx.doi.org/10.2139/ssrn.2980917

Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility – where are they? A critical review of ESG investing. *Review of Financial Economics, 26*(1), 25-35. https://doi.org/10.1016/j.rfe.2015.03.004

Investment Monitor (2022a). *What impact will the Russia-Ukraine conflict have on investment in the defence industry?* Retrieved on November 14th, 2022, from https://www.investmentmonitor.ai/special-focus/ukraine-crisis/russia-ukraine-conflict-defence-industry-fdi-esg

Investment Monitor (2022b). *What impact will the Russian invasion of Ukraine have on ESG investing?* Retrieved on November 14th, 2022, from https://www.investmentmonitor.ai/special-focus/ukraine-crisis/russian-invasion-ukraine-esg-investing

Investment Officer (2022). *Goldman Sachs: ESG Implications of Russia-Ukraine Conflict.* Retrieved on November 11th, 2022, from https://www.investmentofficer.nl/partners/goldman-sachs-asset-management/goldman-sachs-esg-implications-russia-ukraine-conflict-0

Ke, R., Sanche, S., Romero-Severson, E., & Hengartner, N. (2020). Fast spread of COVID-19 in Europe and the US suggests the necessity of early, strong and comprehensive interventions. *medRxiv*. https://doi.org/10.1101/2020.04.04.20050427

Kick, A., & Rottmann, H. (2022). Sustainable Stocks and the Russian War on Ukraine – an Event Study in Europe. *CESifo Working Paper No. 9798*. http://dx.doi.org/10.2139/ssrn.4137955

KPMG Impact (2020). *The KPMG Survey of Sustainability Reporting 2020.* Retrieved on November 8th, 2022, from https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/11/the-time-has-come.pdf

Kumar, N.C.A., Smith, C., Badis, L., Wang, N., Ambrosy, P., & Tavares, R. (2016). ESG factors and risk-adjusted performance: a new quantitative model. *Journal of Sustainable Finance & Investment, 6*(4), 292-300. https://doi.org/10.1080/20430795.2016.1234909

La Torre, M., Mango, F., Cafaro, A., & Leo, S. (2020). Does the ESG Index Affect Stock Return? Evidence from the Eurostoxx50. *Sustainability, 12*(16). https://doi.org/10.3390/su12166387

Lee, S., Lee, D., Hong, C., & Park, M.-H. (2022). Performance of socially responsible firms during the COVID-19 crisis and trading behavior by investor type: Evidence from the Korean stock market. *Finance Research Letters, 45*. https://doi.org/10.1016/j.frl.2021.102660

Library of Congress (2022). *Sweden: Parliament Directs Government to Take Measures Regarding Swedish Energy Supply and Russian Oil and Gas Imports.* Retrieved on November 11th, 2022, from https://www.loc.gov/item/global-legal-monitor/2022-07-27/sweden-parliament-directs-government-to-take-measures-regarding-swedish-energy-supply-and-russian-oil-and-gas-imports/

Limkriangkrai, M., Koh, S., & Durand, R. B. (2017). Environmental, Social, and Governance (ESG) Profiles, Stock Returns, and Financial Policy: Australian Evidence. *International Review of Finance, 17*(3), 461-471. https://doi.org/10.1111/irfi.12101

Lins, K. V., Servaes, H., & Tamayo, A. (2017). Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis. *The Journal of Finance, 72*(4), 1785-1824. https://doi.org/10.1111/jofi.12505

Luo, D. (2022). ESG, liquidity, and stock returns. *Journal of International Financial Markets, Institutions and Money, 78.* https://doi.org/10.1016/j.intfin.2022.101526

MacKinlay, A. C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature, 35*(1), 13–39. Available at JSTOR: http://www.jstor.org/stable/2729691

Martins, A. M., & Cro, S. (2022). Airline stock markets reaction to the COVID-19 outbreak and vaccines: An event study. *Journal of Air Transport Management, 105*. https://doi.org/10.1016/j.jairtraman.2022.102281

Milonas, N., Rompotis, G., & Moutzouris, C. (2022). The Performance of ESG Funds vis-à-vis Non-ESG Funds. *The Journal of Impact and ESG Investing. 2*(4). 96-115. https://doi.org/10.3905/jesg.2022.1.041

Miyajima H., & Yafeh, Y. (2007). Japan's banking crisis: An event-study perspective. *Journal of Banking & Finance. 31*(9). 2866-2885. https://doi.org/10.1016/j.jbankfin.2007.03.006

Nerlinger, M., & Utz, S. (2022). The impact of the Russia-Ukraine conflict on energy firms: A capital market perspective. *Finance Research Letters, 50.* https://doi.org/10.1016/j.frl.2022.103243

Omura, A., Roca, E., & Nakai, M. (2021). Does responsible investing pay during economic downturns: Evidence from the COVID-19 pandemic. *Finance Research Letters, 42*. https://doi.org/10.1016/j.frl.2020.101914

Pavlova, I., & de Boyrie. M. E. (2022). ESG ETFs and the COVID-19 stock market crash of 2020: Did clean funds fare better? *Finance Research Letters, 44*. https://doi.org/10.1016/j.frl.2021.102051

Refinitiv (2022*). Environmental, Social and Governance Scores from Refinitiv*. Retrieved on November 17th, 2022, from https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

Sveriges Riksbank (2022). Retrieved on September 23rd, 2022, from https://www.riksbank.se/en-gb/statistics/search-interest--exchange-rates/

Robeco (2022). *RobecoSAM Country Sustainability Ranking.* Retrieved on November 1st, 2022, from https://www.robeco.com/en/key-strengths/sustainable-investing/country-ranking/

SEB Group (2022). *SEB Investment Management updates the sustainability policy for investments in the defence industry.* Retrieved on November 14th, 2022, from https://sebgroup.lu/private/information-for-investors/news/seb-investment-management-updates-the-sustainability-policy-for-investments-in-the-defence-industry

Shanaev, S., & Ghimire, B. (2022). When ESG meets AAA: The effect of ESG rating changes on stock returns. *Finance Research Letters, 46*(A). https://doi.org/10.1016/j.frl.2021.102302

Sustainalytics (2020). *COVID-19 in Country Risk Ratings*. Retrieved on November 23rd, 2022, from https://connect.sustainalytics.com/hubfs/INV/Methodology/Methodology%20spotlight_Covid-19%20and%20CRR_15-Sep-20.pdf

Sustainalytics (2022). *Systemic Events in ESG Risk Ratings*. Retrieved on November 23rd, 2022, from https://connect.sustainalytics.com/hubfs/INV/Thought%20Leadership/ESG%20Spotlight/Morningstar%20Sustainalytics_Systemic%20Events%20in%20ESG%20Risk%20Ratings_Mar2022.pdf

Takahashi, H., & Yamada, K. (2021). When the Japanese stock market meets COVID-19: Impact of ownership, China and US exposure, and ESG channels. *International Review of Financial Analysis*, *74*. https://doi.org/10.1016/j.irfa.2021.101670

Umar, M., Riaz, Y., & Yousaf, I. (2022). Impact of Russian-Ukraine war on clean energy, conventional energy, and metal markets: Evidence from event study approach. *Resources Policy*, *79*. https://doi.org/10.1016/j.resourpol.2022.102966

UNEP Finance Initiative (2005). *A legal framework for the integration of environmental, social and governance issues into institutional investment.* Retrieved on November 8th, 2022, from https://www.unepfi.org/fileadmin/documents/freshfields_legal_resp_20051123.pdf

Verheyden, T., Eccles, R. G., & Feiner, A. (2016). ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification. *Journal of Applied Corporate Finance, 28*(2), 47-55. Available at SSRN: https://ssrn.com/abstract=2834790 or https://doi.org/10.1111/jacf.12174

White House, The (2022). *Remarks by President Biden Providing an Update on Russia and Ukraine*. Retrieved on November 17th, 2022, from https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/02/18/remarks-by-president-biden-providing-an-update-on-russia-and-ukraine-2/

Yousaf, I., Patel, R., & Yarovaya, L. (2022). The reaction of G20+ stock markets to the Russia–Ukraine conflict "black-swan" event: Evidence from event study approach. *Journal of Behavioral and Experimental Finance*, *35*. https://doi.org/10.1016/j.jbef.2022.100723

Zhong, J., Bollen, M., & Ronnberg, S. (2021). Towards a 100% renewable energy electricity generation system in Sweden. *Renewable Energy, 171*, 812-824. https://doi.org/10.1016/j.renene.2021.02.153

9. Appendices

Appendix A. Literature Review Summary

Subsection	Authors	Geography	Ratings source	Conclusions
General	Kumar et al. (2016)	Global (23 markets)	Dow Jones Sustainability Index (DJSI)	ESG ↑ ➔ stock returns ↑ volatility ↓
General	Verheyden et al. (2016)	Global (23 developed and 23 emerging markets)	Sustainalytics (a Morningstar Company)	ESG screening ➔ tail risk ↓ risk-adjusted returns ↑
General	Milonas et al. (2022)	USA, Europe	MSCI, Morningstar	funds investing in ESG ↑ stocks ≠ returns ↑
General	La Torre et al. (2020)	Europe	CSRHub	ESG ↑ ➔ stock returns ↑ (only for a few companies in the energy and utilities business) ESG ↑ ≠ stock returns ↑ (for all other companies)
General	Brammer et al. (2006)	U.K.	EIRIS	ES ↑ ➔ stock returns ↓
General	Luo (2022)	U.K.	Thomson Reuters' Refinitiv	ESG ↑ ➔ stock returns ↓
General	Lins et al. (2017)	USA	MSCI	CSR ↑ ➔ stock returns ↑ by 4-7% compared to peers
General	Galema et al. (2008)	USA	KLD Research & Analytics (now MSCI KLD)	SRI ↑ (particularly environment, product, and diversity matters) ➔ stock returns ↑
General	Eccles et al. (2012)	USA	Thomson Reuters ASSET4, Bloomberg	ESG ↑ ➔ stock returns ↑ (particularly for the natural resource extraction industry and reputation reliant companies)
General	Glossner (2017)	USA, Europe	RepRisk	ESG risks ↑ ➔ long-term stock returns ↓
General	Halbritter and Dorfleitner (2015)	USA	Thomson Reuters ASSET4, Bloomberg and KLD (now MSCI)	ESG ↑ ≠ stock returns ↑

General	Becchetti and Ciciretti (2006)	USA	DSI 400 KLD (now MSCI KLD 400 Social Index)	ESG ↑ ≠ stock returns ↑ (without industry controls) ESG ↑ ➔ stock returns ↓ (with industry controls)
General	Limkriangkrai et al. (2017)	Australia	Regnan	ESG ↑ ≠ stock returns ↑ (when adjusted for Fama-French-Carhart risk factors)
COVID-19	Ding et al. (2021)	Global (61 economies)	Thomson Reuters ASSET4	ESG ↑ ➔ decrease in stock returns ↓
COVID-19	Omura et al. (2021)	Global, US, Japan, Europe	MSCI	ESG ↑ ➔ decrease in stock returns ↓
COVID-19	Ferriani and Natoli (2021)	Global	Morningstar	ESG ↑ ➔ performance ↑
COVID-19	Pavlova and de Boyrie (2022)	Global	Morningstar, MSCI	ESG ↑ ≠ decrease in stock returns ↓ (in the case of ETFs)
COVID-19	Engelhardt et al. (2021)	Europe (16 markets)	Refinitiv	ESG ↑ ➔ abnormal returns ↑ volatility ↓ (low-trust economies)
COVID-19	Cardillo et al. (2022)	Europe	Refinitiv	ESG ↑ ➔ stock performance ↑ (however, should be analyzed along with financial indicators)
COVID-19	Frambo and Kok (2022)	USA	Sustainalytics (a Morningstar Company)	ESG risk ↓ ➔ performance ↑
COVID-19	Garel and Petit-Romec (2021)	USA	Thomson Reuters Asset4	E ↑ ➔ stock returns ↑
COVID-19	Broadstock et al. (2021)	China	SynTao Green Finance	ESG ↑ ➔ stock returns ↑ (conclusion valid particularly during times of crisis)
COVID-19	Lee et al. (2022)	Korea	Dow Jones Sustainability Indices (DJSI)	CSR ↑ ➔ returns ↑ CSR ↓ ➔ volatility ↑
COVID-19	Takahashi and Yamada (2021)	Japan	Refinitiv	ESG ↑ ≠ abnormal returns ↑
RU-UA War	Basnet et al. (2022)	Global	Refinitiv	ESG ↑ ➔ adverse market response upon the exit announcement from the Russian market ↓

RU-UA War	Kick and Rottmann (2022)	Europe (15 developed economies)	Datastream	ESG ↑ ≠ abnormal returns ↑ ESG ↑ ➔ risk protection ↑
RU-UA War	Umar et al. (2022)	Global	-	clean energy abnormal returns ↑ (among different energy industries, higher abnormal returns compared to conventional energy)
RU-UA War	Nerlinger and Utz (2022)	Global	-	renewable energy cumulative average abnormal returns ↑ (in Europe – overperformer compared to other energy industries; in North America - oil and gas still in leading position)

Appendix B. Market Model and Fama-French Factor Models

OLS Market Model:

$$E(R_{i\tau}) = \hat{a}_i + \hat{\beta}iR_{m\tau} \quad (3)$$

Fama-French 3-Factor Model:

$$E(R_{i\tau}) = \hat{a}_i + \hat{\beta}_{1i}R_{m\tau} + \hat{\beta}_{2i}SMB_{\tau} + \hat{\beta}_{3i}HML_{\tau} \quad (4)$$

Carhart 4-Factor Model:

$$E(R_{i\tau}) = \hat{a}_i + \hat{\beta}_{1i}R_{m\tau} + \hat{\beta}_{2i}SMB_{\tau} + \hat{\beta}_{3i}HML_{\tau} + \hat{\beta}_{4i}WML_{\tau} \quad (5)$$

Fama-French 5-Factor Model:

$$E(R_{i\tau}) = \hat{a}_i + \hat{\beta}_{1i}R_{m\tau} + \hat{\beta}_{2i}SMB_{\tau} + \hat{\beta}_{3i}HML_{\tau} + \hat{\beta}_{4i}RMW_{\tau} + \hat{\beta}_{5i}CMA_{\tau} \quad (6)$$

Appendix C. Robustness Check for FF4

We perform a robustness check for both events (Table 8). We stick to CAAR values on *t* and *t+5* for simplicity. Both tables reveal that the values produced by our model of preference – the Carhart 4-Factor Model (FF4) - are synchronized with those produced by other models, i.e., market model, Fama-French 3-Factor model (FF3) and Fama-French 5-Factor model (FF5) and give similar levels of significance.

Table 8. Robustness check for the 11-day event window CAARs for Event 2

	ESG_DIFF			
Model	CAAR[0, 0]	CAAR[-5, +5]	CAAR[0, 0]	CAAR[-5, +5]
Market Model	0,0056	0,0187	0,0340***	0,0240
FF3	0,0082	0,0179	0,0398***	0,0422**
FF4	0,0094	0,0324	0,0382***	0,0399***
FF5	0,0092	0,0243	0,0357***	0,0366***

Appendix D. Exposure component for Event 2

We perform an additional test by computing the difference in CAAR between *S_EXP* and *S_NEXP*, where S = *L_ESG* or *H_ESG*. Both categories, *H_ESG* and *L_ESG*, showed a statistically insignificant difference in performance of exposed and non-exposed firms. Thus, we eliminate the uncertainty of whether exposure was playing an important part in driving Event 2 results, by concluding that it wasn't.

Table 9. Exposure to Russia/Ukraine: 11-day event window CAARs

	EXP - NEXP	
Day	H_ESG	L_ESG
t-5	-0,0019	-0,0004
t-4	-0,0032	-0,0035
t-3	0,0021	0,0017
t-2	-0,0008	-0,0030
t-1	-0,0016	-0,0048
t	-0,0064	-0,0203
t+1	-0,0114	-0,0286
t+2	-0,0176	-0,0103
t+3	-0,0294	-0,0191
t+4	-0,0275	-0,0328
t+5	-0,0208	-0,0500

Note: Significance level is shown as ***p < 0.01, **p < 0.05, *p < 0.1.