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## Abstract

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JEL Classification: E3, G14, G01, Q54

Keywords: Climate transition risk, Energy, ESG, Event studies, inflation, resilience, Russia-Ukraine war, Stock returns



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April 11, 2022

COMMENTS WELCOME

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## 1 Introduction

This study investigates the stock price reactions of firms around the globe to the Russia-Ukraine war in early 2022 and its consequences. While the invasion on February 24, 2022 had been visibly prepared in the prior months, many observers still were surprised that Russian President Vladimir Putin went ahead with this step. In aggregate, most stock markets initially reacted very negatively, though they had rebounded by the end of March even as countries worldwide put escalating sanctions in place.[1] Understanding which companies were most affected and which were relatively resilient to this crisis is important precisely in the face of the human tragedy unfolding for all involved parties. Moreover, the specific nature of the conflict provides a sad but unique situation to study the firm value implications of a wide range of factors, including the energy transition, inflation, and international orientation.

Anecdotal evidence and market commentary abound on what factors influenced stock returns during the Russia-Ukraine crisis. However, such typically univariate analyses face the challenge that many relevant firm characteristics (like sustainability, international activities, sensitivity to interest rates, financial performance, among others) are correlated. Regressions controlling for a variety of factors can help distinguish which factors remain important after considering these common traits.

After a brief review of country-average and industry-average returns drawing on roughly 14,500 stocks (above a minimum size threshold), our primary focus is on the cross-section of roughly 3,500 global stocks for which we have a wide variety of firm characteristics. We consider three phases: *Build-up* (from the time NATO put its troops on stand-by on January 24 through February 23), *Outbreak* (from February 24, the day of the invasion, through March 8, the day after the US announced to ban Russian oil, gas,

[1] That rebound and ensuing seeming calm enticed the Financial Times to describe the situation as "Snooze at the Sound of Cannons", April 2, 2022.

and coal), and *Continuation* (from March 9 through March 31). Our key findings – all obtained while controlling for industry fixed and country fixed effects – are as follows.

First, in all three phases, but especially in Outbreak and Continuation, firms with high climate transition risk did well, particularly in the US. We establish this result using two different measures, one based on corporate conference calls (Sautner et al., 2020) and the other based on 10-K disclosures (Kölbel et al., 2020). These results suggest that investors generally expect the transition to a low-carbon economy to slow down. Strikingly, in Europe, stocks with high transition risk did not exhibit such outperformance and in fact underperformed in the Outbreak period. This observation may be due to stronger expected policy responses supporting renewable energy sources, which, given Europe's relatively pronounced dependency on Russian oil and gas, is arguably the only way for Europe to enhance its energy security. In short, the speed of transition to a low-carbon economy appears to be diverging between the US and Europe.

Second, some Environmental, Social, and Governance (ESG) measures are positively related to performance in some of the three periods (but then reverse); others negatively (and then reverse); others not at all. These mixed findings for ESG measures are to be expected given the "aggregate confusion" surrounding them (Berg, Kölbel, and Rigobon, 2022). Hence, investors cannot easily rely on such scores for their investment decisions in the face of a disaster like war. The results for the arguably more objective measures of transition risk provide a consistent picture of sustained performance differences and can be justified economically.

Third, firms for which a textual measure suggests strong exposure to inflation risks performed worse, especially in the Outbreak period. The fact that the underperformance of these stocks continues into the Continuation period resonates well with a statement made by European Central Bank's Christine Lagarde. In a news conference on March 10, 2022, she stated that the "Russia-Ukraine war will have a material impact on economic

activity and inflation through higher energy and commodity prices, the disruption of international commerce and weaker confidence."[2] Our analysis reveals that inflation risk is an ongoing concern for investors.

Fourth, the data also point to investors' concerns regarding the international exposure of companies in general. Companies with a higher share of international sales underperformed. For US companies, we employ a text-based proxy for exposure to China, and we find that China-oriented companies strongly underperformed (net of all other effects) during the Outbreak period. These findings suggest that global supply chains and international sales funnels became more risky in the perception of investors. They also point to wider-ranging geopolitical consequences of the war, particularly to a further increased tension between the US and China. All these findings hold when we control for whether a firm (possibly later in the sample period) "self-sanctioned" by leaving Russia (partially or completely). Such firms experienced an additional discount, though the causality could also run from negative stock price responses early on to the choice to leave Russia later.[3] We also find that, as was the case in the early phase of COVID-19, firms with strong financials did better after the invasion.

Overall, the results show how investors navigate a unique amalgam of geopolitical, macroeconomic, and (environmental) policy challenges. Considerations regarding energy security turn out to play a major role for firm value. Thus, this analysis contributes to the literature by providing a systematic analysis of a wide range of factors driving firm value in a situation not witnessed for a very long time, namely, a war in Europe.

Our work is related to the literature on rare disasters and its impact on financial markets. When investors price in the tail risk of future disaster events, this can help explain some puzzles in finance (e.g., excess volatility and high equity premiums), as

[2]See `https://www.ecb.europa.eu/press/pressconf/2022/html/ecb.is220310~1bc8c1b1ca.en.html`.

[3]Stocks with higher ESG scores tend to have had more Russia exposure in the first place, see `https://corpgov.law.harvard.edu/2022/03/16/the-false-promise-of-esg/`.

shown, for example, in Gabaix (2012), Gourio (2012), and Wachter (2013). However, the exposure of firms to tail risk events is difficult to assess empirically because, fortunately, such events rarely materialize. Unsurprisingly, the empirical investigation of disaster risks has recently gained traction, particularly as a result of the COVID-19 crisis. Important insights regarding what variables are important in crisis times also come from the study of the Global Financial Crisis (GFC).[4] In the COVID-19 crisis, financial strength of companies played a major role (Ding et al., 2021; Fahlenbrach, Rageth, and Stulz, 2021; Ramelli and Wagner, 2020). We find that this factor also played a role in the Russia-Ukraine crisis. In the early phase of the COVID-19 crisis, internationally oriented companies suffered, arguably due to worries about supply chains (Ramelli and Wagner, 2020). We observe a similar effect in the Russia-Ukraine war. During the GFC, high-ESG firms did well, arguably because of the higher trust they were able to garner (Lins, Servaes, and Tamayo, 2017). There is also some evidence that firms with stronger ES performance did better in the COVID-19 crisis (Albuquerque et al., 2020; Garel and Petit-Romec, 2021), though this result has been the subject of some debate (Demers et al., 2021). As noted above, the evidence on whether ESG performance was a factor supporting the resilience of firms in the Russia-Ukraine crisis is mixed at best, but energy and climate transition risk played a major role.

Our paper is also related to the wider literature on the pricing of climate risks. Several studies suggest that transition risks are priced with a "carbon premium" in equity markets (Bolton and Kacperczyk, 2020; Engle et al., 2020), as well as in corporate credit markets (Delis, Greiff, and Ongena, 2019; Duan, Li, and Wen, 2020). For example, Bolton and Kacperczyk (2021) use carbon dioxide emissions as a proxy for transition risk and find that stocks of firms with higher emissions earn higher returns. Hence, investors seem to demand compensation for their exposure to transition risk. The pricing implications of

[4]The GFC originated from finance, whereas the COVID-19 pandemic is an event more exogenous to corporations.

physical climate risk are less clear. In fact, several studies argue that there is a mispricing of physical risks in equity markets (Bansal, Kiku, and Ochoa, 2016; Hong, Li, and Xu, 2017). Our study shows that geopolitical disruptions have subtle effects on how transition risk is priced into equity markets.

Finally, some studies have directly considered the impact of war on financial markets. While most of the literature has its focus on World War II,[5] Schneider and Troeger (2006) analyze three recent international conflicts, i.e., the Gulf War, the conflict between Israel and Palestine, and the Civil War in Ex-Yugoslavia. They find that international markets mostly react negatively to war. Brune et al. (2015) find that an increase in the war likelihood tends to decrease stock prices, but the ultimate outbreak of war increases them. However, when a war starts unexpectedly, the outbreak of war decreases stock prices. These observations can be explained in the presence of ambiguity aversion when uncertainty resolves. Hence, through the lens of Brune et al. (2015), our findings suggest that the Russian invasion took equity markets by surprise. Related work considers a geopolitical risk index provided by Caldara and Iacoviello (2022). This newspaper-based geopolitical risk index is being increasingly used as a predictor to forecast economic variables out-of-sample.[6]

The current war will surely spur intense scrutiny by researchers. Using country-level data, Federle et al. (2022) find that stock markets of countries located closer to Ukraine lost more value in the short term. Huang and Lu (2022) find that equity markets of countries that impose sanctions lose more value, and they also find that firms that exit Russia perform worse. We conduct a firm-level analysis. Our focus is on energy and climate transition risk, ESG, financial strength, other international links (e.g., with China), and other factors.

[5] See, e.g., Frey and Kucher (2000), Frey and Kucher (2001), Frey and Waldenström (2004), Choudhry (2010), and Hudson and Urquhart (2015).

[6] See, among others, Nonejad (2022), Wang et al. (2021), Plakandaras, Gupta, and Wong (2019), Mei et al. (2020), and Nonejad (2021).

The remainder of the paper is structured as follows. Section 2 presents the timeline and summarizes how attention of investors developed. Section 3 presents the data sources. Section 4 reviews evidence on the country and industry level. Section 5 summarizes the main results. Section 6 concludes.

## 2 Dates of Key Events and Investor Attention

There have been tensions between Russia and Ukraine for a long time, not least since the annexation of Crimea in 2014. In spring 2021, Russia began amassing a large number of troops and equipment. A second build-up began in October 2021. Despite these rising tensions, we restrict our event study to the beginning of 2022. In particular, we explore three different periods, which we label *Build-up* (Monday, January 24 to Wednesday, February 23), *Outbreak* (Thursday, February 24 to Tuesday, March 8), and *Continuation* (Wednesday, March 9 through Thursday, March 31).

First, on January 24, NATO put its troops on standby, and on January 25, Russian exercises involving 6,000 troops and 60 jets took place in Russia near Ukraine and Crimea. Moreover, on January 25, White House officials stated the US, alongside allies and partners, was prepared to implement sanctions with "massive consequences that were not considered in 2014" (the Crimea crisis), including financial sanctions and export controls on US software and technology. They added, "the gradualism of the past is out, and this time we'll start at the top of the escalation ladder and stay there."[7]

Second, on February 24, Russia invaded Ukraine. The United Nations (UN) convened the General Assembly during an emergency special session on February 28 and concluded the session on March 2. While several countries were putting increasingly severe sanctions against Russia, arguably a particularly strong signal, at least diplomatically, was the March 8 announcement by President Joe Biden that his administration would ban Russian

[7] See `https://www.piie.com/blogs/realtime-economic-issues-watch/russias-war-ukraine-sanctions-timeline`.

oil, natural gas, and coal imports to the US.

Third, the "*Continuation*" period lasts from March 8 through March 31, the most recent date for which we employ stock market data. The crisis is ongoing and may enter another phase soon. Therefore, we plan on extending our analysis online as the situation develops.

As a rationale for the choice of these three periods, we rely on observations gleaned from the development of proxies for investor attention, summarized in Figure 1. We consider corporate earnings calls as an indicator of professional investor (and managerial) attention, and Google search volume as an indicator of retail investor attention. Specifically, in all earnings conference call transcripts obtained from Refinitiv Company Events Coverage (formerly Thomson Reuters StreetEvents), we search for the keywords "RUSSIA","UKRAINE","RUSSIAN", "UKRAINIAN", "WAR". As can be seen in Figure 1, the fraction of conference calls mentioning these keywords remains relatively stable through February 24, when it jumps up and remains elevated.[8] Thus, while Russian troop movements have been a concern since October 2021, and U.S. intelligence agencies had warned of an imminent invasion as early as mid-February, corporate managers and analysts do not appear to have focused explicitly on this issue until the invasion actually occurred.

– Figure 1 here –

With regards to the proxy for retail investor attention, we observe that the Google search volume for "Russia" and "Ukraine" ticks up briefly on January 24, 2022, which marks the beginning of the "Build-up" period. It then jumps dramatically on February 24, the start of "Outbreak". It then fairly quickly subsides, though it remains substantially

[8]The fact that the absolute number of conference calls on February 24 is high is a coincidence. In prior years, too, the highest number of conference calls in February occurred on the last Thursday in that month.

above the level prior to the invasion even towards the end of March.[9]

## 3 Data and Sample Construction

We employ data from Compustat North America and Compustat Global (obtained via WRDS). We select all stocks with valid prices since January 01, 2022. We only keep stocks with a market capitalization larger than USD 10 million and stock prices larger than USD 1 by the end of 2021 to avoid results being driven by penny stocks. We have around 14,500 stocks from 59 countries in the sample with valid returns (see Table A2 in the Appendix). Further merging with additional data leaves us with a sample of around 3,500 stocks that has a complete set of different firm characteristics. Some countries drop from the final sample in particular because conference call data are not available, but also because ESG score coverage is minimal. For all the details on variable definitions, we refer to Table A1 in the Appendix.

### 3.1 Stock returns and firm characteristics

For stock returns, we collect daily stock price information. We calculate the total returns of the three periods (Build-up, Outbreak, and Continuation), respectively. We adjust prices for dividends through the daily multiplication factor and the price adjustment factors provided by Compustat.

We employ the Fama-French five-factor model plus momentum to measure the market beta. For developed markets, we use one year of daily data before December 31, 2021, in this calculation. Since factors in the Fama French library are updated only monthly for emerging markets, we use five years of monthly data before December 31, 2021.

We then merge the price information with the accounting variables also obtained from Compustat. We use accounting data from the latest 2021 quarterly results referring to

[9] A similar picture emerges when considering coverage of the war on television. See `https://blog.gdeltproject.org/how-is-ukraine-being-covered-on-television-news-3/`.

periods ending before January 1, 2022. All accounting variables in our analyses are, therefore, predetermined to stock returns. For non-US firms which have dual listing stocks in the US and their home country, we first take the data available from its home country.

Firm size is measured as the natural logarithm of the market capitalization (in millions). BTM is defined as the natural logarithm of the book-to-market ratio (book equity divided by market capitalization). Cash is defined as the cash and short-term investments divided by total assets. Leverage is calculated as the long-term debt plus debt in current liabilities divided by total assets. Profitability is proxied by the return on assets (ROA), defined as income before extraordinary items divided by total assets. All non-ratio values are transformed to dollar values with the exchange rate at the end of 2021 provided by Compustat.

### 3.2 Climate risk exposure

We use two different data sources to proxy for climate risk exposure, for which we differentiate between exposure to transition risk and physical climate risk. Because they feature prominently in our analysis, we describe them in some detail to ensure the paper is self-contained.

Sautner et al. (2020) utilize quarterly earnings conference calls from a global sample. Based on an initial bigram set, they first uncover, through machine learning algorithms, a set of bigrams relevant to climate change topics. Second, they construct climate change exposure measures based on the number of occurrences of the specified bigrams. Specifically, they generate four different topic bigrams (climate change, climate change opportunity, climate change regulatory, and physical climate change) and three measures for each bigram (exposure, sentiment, and risk). Finally, they show that the text-based measure captures firm-level climate exposure variation better than other measures such

as carbon intensities or ESG performance and risk scores. Therefore, we use the transition ($Trans^{ECC}$) and physical ($Phy^{ECC}$) risk scores in this paper, where ECC stands for earnings conference calls.

Kölbel et al. (2020) use a contextual natural language processing approach based on BERT[10] to extract transition and physical risk information from 10-Ks. (Therefore, this measure is only available for US firms, though the headquarters may be in another country.) Specifically, Kölbel et al. (2020) focus on Item 1.A of the 10-K report, where firms are obliged to report relevant risk factors. Kölbel et al. (2020) implement a multi-classification algorithm based on BERT to learn whether each sentence is relevant to transition or physical risk, further aggregated on a document level to measure firm-specific exposure to transition and physical risk. The measure is economically validated on CDS market data and shows that transition risks increased CDS spreads in the wake of the Paris Agreement in 2015 and decreased after the Trump election. By contrast, the disclosure of physical risks decreases CSD spreads for companies materially exposed to physical climate risks through an uncertainty reduction mechanism. We use their regulatory exposure ($Trans^{10K}$) and physical exposure ($Phy^{10K}$) scores in this paper.

### 3.3 ESG measures

We also control for ESG scores in our analysis. For the main analysis, we employ the overall ESG score from Refinitiv (formerly known as Asset 4), obtained as of the end of the calendar year 2021. These data maximize the sample size and have been used in several other recent studies, e.g., Albuquerque et al. (2020), Dyck et al. (2019), and Ferrell, Liang, and Renneboog (2016). We also employ a series of other ESG measures, namely, the Bloomberg ESG score, MSCI ESG rating, RepRisk ESG reputational risk

[10]BERT is the acronym for Bidirectional Encoder Representations from Transformers. It is a deep neural network-based machine learning technique used for natural language processing (Devlin et al., 2018).

score, S&P Global ESG rank, and Sustainalytics ESG risk score. The ESG measures from Refinitiv, Bloomberg, MSCI, and S&P Global are performance measures. The ESG measures from Sustainalytics and RepRisk are risk measures, i.e., they capture firms' risk exposure to ESG-related topics.[11]

### 3.4 Inflation exposure

We construct a simple proxy of inflation exposure (%INF) using the earnings conference call data. First, we count the total number of occurrences of three keywords (INFLATION, CPI, PPI) and normalize by the total number of words in the call. Next, we compute the variable for each conference call during 2021 and compute the average by firm.

### 3.5 Geopolitical and international exposure

A first, straightforward measure of exposure to the war derives from how much corporate managers and analysts refer to the involved countries and the (possibility of) war. Specifically, in each earnings conference call transcript, we count the total number of occurrences of five terms relevant to the current war situation (RUSSIA, RUSSIAN, UKRAINIAN, UKRAINE, WAR) and normalize that count by the total number of words in the call. Then, for each firm, a variable (%War) is constructed by taking the mean of the war relevant keywords counting ratio from all the earnings conference calls during the period January 1, 2021, through February 23, 2022 (that is, just before the Outbreak period starts).

The second approach uses a measure in the spirit of Hoberg and Moon (2017). These authors construct a text-based variable from 10-K filings to capture the offshore activities

[11] For S&P Global, Bloomberg, MSCI, and Sustainalytics, we use the data downloaded from Bloomberg shortly after the invasion. As only the most recent data, not historical scores, are available without limitation in our subscription, it is possible that some data were updated just as the war started to develop.

(offshore sale of output, purchase of input, and ownership of assets) of firms. The number of times a country is mentioned constitutes a proxy for the firm's exposure to that country. Ramelli and Wagner (2020) apply these data to study international exposure during the COVID-19 crisis. We focus on the two countries, Russia and Ukraine, which are at the center of the conflicts, and China, which plays an essential role in the global supply chain and international relations. Hoberg and Moon (2017) provide their data until 2017. To update the data to the most recent year, we have replicated their measure as closely as possible. We compute the number of times each of these three countries is mentioned, #Russia, #Ukraine, and #China. Our measure and the corresponding measure from the original paper yield an average correlation of 0.75 for the common historical sample.

Third, we obtain the percentage of revenues generated from international sales, measured at the end of calendar year 2021, from S&P Global Capital IQ.

## 4 Country- and Industry-level evidence

We begin by laying out descriptive evidence on the average stock's performance across countries and industries. Figure 2 shows that while in almost all countries, average equity returns were negative in the Build-up and, in particular, in the Outbreak period, the average firm delivered strongly positive returns in the Continuation period.[12] Relatively positive performers in the Outbreak period were stocks in Canada and the US (in addition to several other smaller countries). By contrast, Russian, French, German, and Italian companies and companies closely connected to Russia economically (the Baltic countries and Austria, for example) suffered. Companies in these countries also saw their volatility rise dramatically.

Not surprisingly, as visible in Figure 3 energy stocks and utilities were the two major

[12]To maximize the numbers of observations for this plot, we retain observations even if some of the accounting variables are missing.

sectors where the average returns were positive in the Outbreak period.[13] Automobiles, consumer services and consumer durables were the worst performers. By contrast, each of the industries delivered positive returns on average in the Continuation period.

– Figures 2 and 3 here –

## 5 Main Results: Firm-level evidence

The Russia-Ukraine war affects firm values in many dimensions. Therefore, we consider a regression analysis including a wide range of potential value drivers for our main analysis. However, the reported key results also hold if we include each of the following aspects separately while only controlling for the general set of firm-level controls (beta, size, book-to-market, ROA, cash, and leverage). These separately run regressions are available on request.

We present the main results in two tables (Tables 2 and 3). Table 2 is organized as follows. There are three blocks of three regressions each. The first block concerns the Build-up period, the second the Outbreak period, the third the Continuation period. In the Outbreak period regressions, we control for returns in the Build-up period; in the Continuation period regressions, we control for returns in the Outbreak period. This approach mitigates concerns that in highly volatile market phases, we merely pick up reversal as we move from one phase to the next. However, the results also hold without these controls. Within each block, the first column shows results for the international sample. The second column adds control variables that are only available for the US, namely, the extent to which companies refer to Russia, Ukraine, and China in their 10-K disclosures. The third column also considers the US but uses the 10-K based transition

[13] Throughout the paper, we adopt the GICS industry classification, mostly because of its broad popularity among practitioners, which fits well with our empirical goal of studying how investors reacted to the Russia-Ukraine war. Bhojraj, Lee, and Oler, 2003 provides evidence on the superior performance of the GICS classification in explaining stock return comovements and other financial similarities.

risk measure. Table 3 then compares results for the US and the European companies.

All regressions control for industry fixed effects and in the global regressions for country fixed effects. The robustness analysis shows that results hold when excluding the energy sector, financials, and utilities.

### 5.1 Climate transition risk and ESG

Can the war be considered a negative shock to the transition to a low-carbon economy? For our global sample of stock returns, Columns (1) and (4) of Table 2 show that already in the Build-up period as well as in the Outbreak period, stocks with high transition risk performed better than their peers. The Continuation period exhibited further drift; see column (7). Thus, the market priced a considerably protracted slowdown in the transition to a low-carbon economy.[14]

– Table 2 here –

In Table 2, Columns (2), (5), and (8), we add measures of companies' international exposure (some of which are available only for US companies). The results for these variables are discussed below, but the findings for climate transition risk remain unchanged. Lastly, columns (3), (6), and (9) employ the BERT-based measure of climate transition risk for those companies that file 10K reports. Again, we find the same result: Firms with higher transition risk did better overall.

Table 3 reveals, however, that these results differ markedly between the US and Europe. For ease of comparison, columns (1), (4), and (7) repeat the findings for the global sample from Table 2. Columns (2), (5), and (8) show that the positive effect for transition risk only obtains in the US. In fact, this arguably reflects not only potentially less stringent regulation in the US, but also higher demand for US fossil fuels from Europe.

[14] During the Outbreak period, firms with above-median transition risk on average have positive returns while firms with below-median transition risk had negative returns.

In Europe itself, by stark contrast, companies with low transition risk outperformed in the Outbreak period; see column (6).[15] Thus, stock market participants anticipated that the war would accelerate the transition to a low-carbon economy for the EU but not in the US. This reaction appears consistent with the different policy stances.[16]

Note that all these results obtain controlling for industry fixed effects. They also hold excluding the energy sector or excluding the financials and utilities sectors. (see Table A4 in the Appendix.)

– Table 3 here –

– Figure 4 here –

Figure 4 illustrates the magnitude of the impact of transition risk on cumulative stock returns over the sample period, as discussed above. The first panel shows the results for the global sample. Clearly, the transition risk score becomes significant starting in mid-February. At the same time, there is no discernible effect from physical risk exposure. This is as expected: The current war is not affecting the climate itself. In the second panel of Figure 4, we observe the same effect for the US but even more robust. Both measures for transition risks become highly significant towards the end of February. This observation contrasts our findings for Europe. Here, the transition risk score does not significantly impact cumulative returns and even has a slightly negative impact as the war unfolds.

These results show the dramatic consequences of the sanctions and the threats to energy security for many countries as they try to wean themselves off Russian fossil fuels. However, it is possible that some of the results reflect broader corporate environmental responsibility or even wider aspects of social responsibility or corporate governance.

[15]The price of the EU carbon permits dropped significantly on Feb 24 but then stabilized in the following days. See `https://tradingeconomics.com/commodity/carbon`.

[16]Financial Times, "EU to step up push for clean power as Ukraine conflict escalates", March 7, 2022

Therefore, throughout, we also control for ESG scores (though the results on transition risk do not depend on this control). The analysis of the role of ESG scores is of interest in its own right because prior work has yielded some indications that some of these scores predict higher resilience to crises such as the GFC and COVID-19. At the same time, there is widespread disagreement about what to measure and how to measure it (Berg, Kölbel, and Rigobon, 2022). In the regressions in Table 2, we begin by using Asset 4 data because the coverage is the widest of the data providers we have access to. The results show that Asset 4 ESG scores were slightly positively related to returns in Buildup, unrelated to returns in Outbreak, and negatively related in Continuation. In Table 4, we conduct checks using other ESG scores, namely, those provided by S&P Global, Bloomberg, MSCI, Sustainalytics, and RepRisk. These scores have somewhat different purposes (some emphasizing ESG performance, some risk), and they are available for different samples. Some of the performance (risk) scores are indeed positively (negatively) related to returns in Outbreak. However, in contrast to the persistent effect from transition risk (and other factors, such as inflation and international exposure, discussed below), for some of the ESG metrics even, if there is a significant effect in Outbreak, there is a tendency for reversal in the Continuation period. There are also some instances in certain periods where there is opposite evidence to the prediction that firms with better ESG scores would fare better during a crisis. There are also many cases of no statistically significant relation. Overall, the picture that emerges is mixed.

– Figure 5 here –

Figure 5 illustrates this finding of the pricing of ESG fluctuating quite strongly within the three periods under consideration. In sum, it appears that none of the ESG scores was related to sustained outperformance in the time period under consideration. Importantly, the findings for transition risk hold throughout when controlling for different types of ESG scores.

### 5.2 Inflation concerns

Even before the war started, inflation concerns had gripped the market. The shortage of energy supplies from Russia and fear of food shortage (e.g., wheat supplies from Ukraine) present a supply shock that can potentially lead to at least temporary inflation (and corresponding monetary policy responses). Are these worries relevant to firm value? The regression results in Table 2 strongly suggest yes. Firms that had talked about inflation more frequently on their earnings conference calls during year 2021 did far more poorly during the Outbreak period. A one standard deviation more frequent mention of inflation predicted a performance reduction by around one percentage point. Strikingly, this effect continued during the Continuation period. Figure 6 illustrates this finding.

– Figure 6 here –

Controlling for inflation exposure also is important because one explanation for the differential performance of firms with high and low climate transition risk and ESG scores is that these firms differ along dimensions other than those related to their environmental and social performance. One prime candidate is, in fact, inflation risk and the risk of rising interest rates. After all, these firms typically exclude energy and other assets that benefit from rising commodity prices. Controlling for corporate inflation talk ameliorates this concern.

### 5.3 International exposure, sanctions, and exposure to the war

Next, we consider firms' international exposure. First, as might be expected, firms that more frequently talked about Russia, Ukraine, or the (possibility of) war in their conference calls during 2021 and in early 2022 (before the Outbreak period) turned out to have significantly worse performance in the Outbreak period, as can be seen from the negative coefficient on %War.

The number of times a US firm mentioned Russia or Ukraine in its 10-K disclosures is not significantly related to stock returns (whether or not we control for %War). However, interestingly, exposure to China was negative in the Outbreak phase and beyond. Table 2 suggests that US companies mentioning supply chain or product market exposure to China by one standard deviation more frequently experienced more than one percentage point lower returns in the Outbreak period, an effect that was sustained into the Continuation period. Arguably, investors worried that given that China did not condemn the Russian invasion, there is a possibility of a further trade or economic conflict between the US and China, which would hurt these firms. Figure 6 illustrates these findings and makes it clear how sustained these effects are.

During the first month of the war in Ukraine, nearly 500 foreign firms had left the Russian market.[17] Clearly, only firms that were active in Russia in the first place can leave. We construct a binary indicator $\mathbb{1}_{Action}$ that picks up these (partial or complete leavers), and another binary indicator, $\mathbb{1}_{Active}$ identifies firms that remain active in Russia. Therefore, the omitted category includes firms that either are not active in Russia or whose actions are unknown at this time. Table 2 shows that those who took action to leave performed significantly worse in the Outbreak period. Causality can run both ways: First, shareholders may expect leaving to be bad for long-term business, or it may signify that these firms will be expected to take other decisions based on moral assessments that some shareholders may consider to run counter to immediate business interests. Second, it is conceivable that when the management of a company engaged in Russia observes a particularly negative stock price effect early on, it interprets this as a critical vote of its shareholders on its Russia activities and then chooses to exit Russia.

In additional results, reported in Table A5, we also control for the percent international sales. This variable is missing for a large part of the sample, which is why we do

[17] `https://som.yale.edu/story/2022/almost-500-companies-have-withdrawn-russia-some-remain`. We thank Jeffrey Sonnenfeld for making these data available on his website.

not include it in the main regressions. We set missing values of international sales equal to zero and include an indicator variable equal to 1 for missing values. International sales enter strongly negatively (and the missing values indicator is mostly insignificant), consistent with the interpretation that investors anticipate this war to have broader geopolitical repercussions that complicate business for internationally oriented firms. The other results also hold in this case.

### 5.4 Financial strength

Finally, we consider two proxies for financial strength, leverage and cash holdings. In the Outbreak phase, more indebted companies performed more poorly. This underperformance may reflect, first, the standard leverage-risk effect that transmits cash flow risk into equity risk. Second, it may reflect the exposure of these firms to more stringent monetary policy and rising interest rates in the face of higher-than-expected inflation.

The strong performance of companies with high cash holdings in the Continuation period is reminiscent of the situation during the COVID-19 pandemic. There was a real risk of disruption in the credit markets and concerns about corporate access to liquidity in the pandemic. It is striking that despite fears of rising inflation, the attractiveness, for companies, of holding cash increased so much in that period.[18]

## 6 Conclusion

Even before war broke out in Ukraine, investors worldwide were facing a unique, challenging mix of events: restart of economic activity after COVID-19, fear of new virus strains, surging inflation, and new monetary policy and central bank frameworks, among others. The tragedy of war in Europe and the prospect of far-reaching geopolitical repercussions added another black swan to the flock.

[18] Although the overall effects for financial strength in Outbreak and Continuation are apparent, the impact of cash and leverage vary substantially within the two periods.

The spread of the conflict, future sanctions, the responses of companies and other countries, and individual behavior are unknown, complicating attempts to quantify the expected economic impact of the war. Fortunately, asset price changes capture current expectations; the researcher does not need to trace all the future changes to cash flows and discount rates separately (Schwert, 1981). Stock price reactions thus offer a preview of the future economic impact of the Russia-Ukraine war.

Our analysis reveals that regulatory climate risks, in particular, play an essential role. Their impact on equity markets depends on the geopolitical situation in the current regions, especially the dependence on Russian energy supplies and trade relations with China. Investors appear to expect the speed of transition to a low-carbon economy to be diverging between the US and Europe. At the same time, this crisis illustrates that ESG measures do not offer a straightforward and consistent guide to which companies are resilient to crises. Furthermore, the findings suggest that inflation fears, easily dismissed by market commentators as a temporary phenomenon before the outbreak of war, have become entrenched and that this specter will not dissipate anytime soon. Finally, investors strongly worry about the wider geopolitical repercussions and potential further conflicts that this war may induce.

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**Figure 1: Attention to War from the Google Trend and Earnings Conference Calls**

This figure plots the attention to the Russian-Ukrainian war measured by Google Trend and Earnings Conference Call. The bar chart with the vertical axis on the left shows the number of the earnings conference call (blue bar) and the number of earnings conference calls with the keywords "RUSSIA"," UKRAINE"," RUSSIAN", "UKRAINIAN", "WAR" (red bar). The line chart with the vertical axis on the right shows the percentage of the earnings conference calls which have mentioned the keywords (red line), the global Google trend of "Russia" (green line), and the global Google trend of "Ukraine" (blue line).

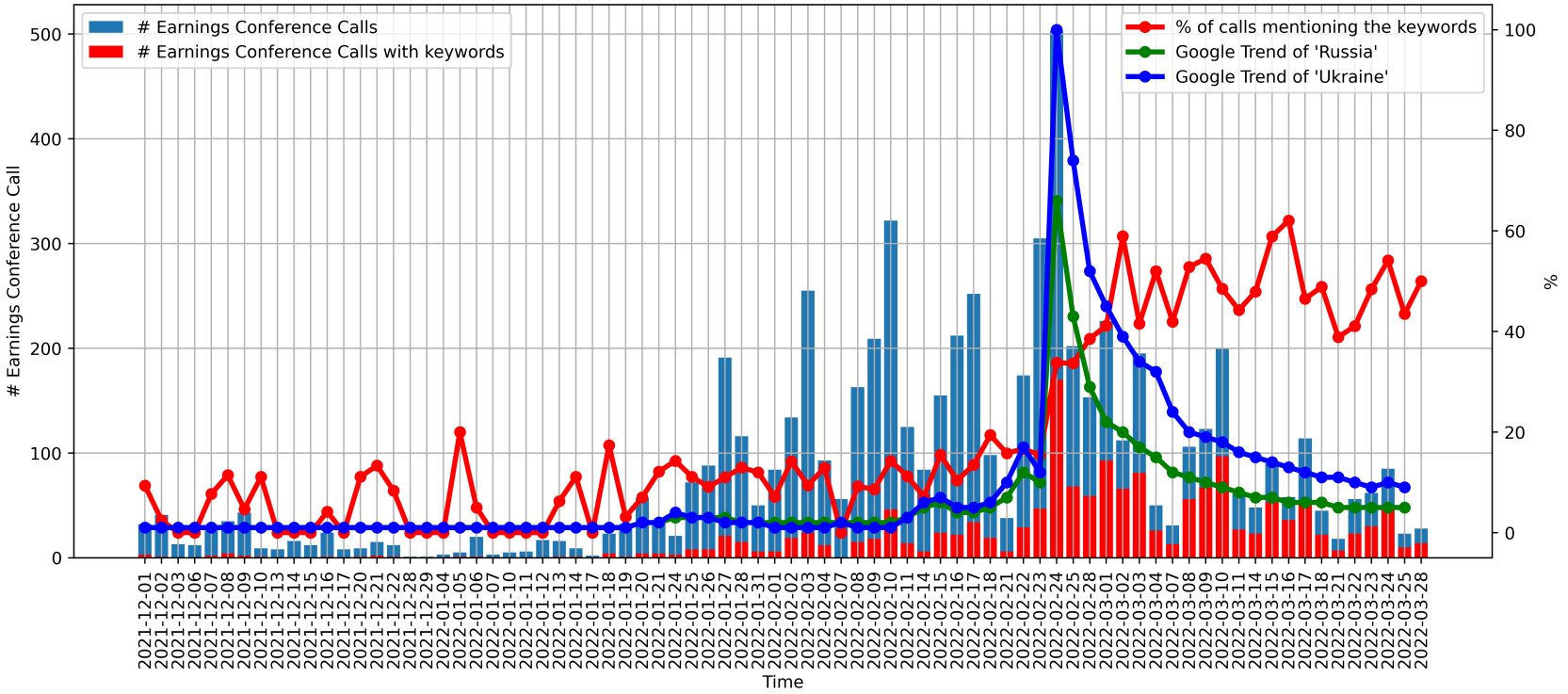


**Figure 2: Stock Market Reaction across Countries/Regions**

This figure plots the market reaction of different countries for three periods: Build-up (January 24 - February 23), Outbreak (February 24 - March 08), and Continuation (March 09 - March 31). The left figure shows the equally weighted cumulative stock returns. The right figure shows the average standard deviation of daily stock returns. The country classification is based on firms' headquarter locations provided by Compustat.

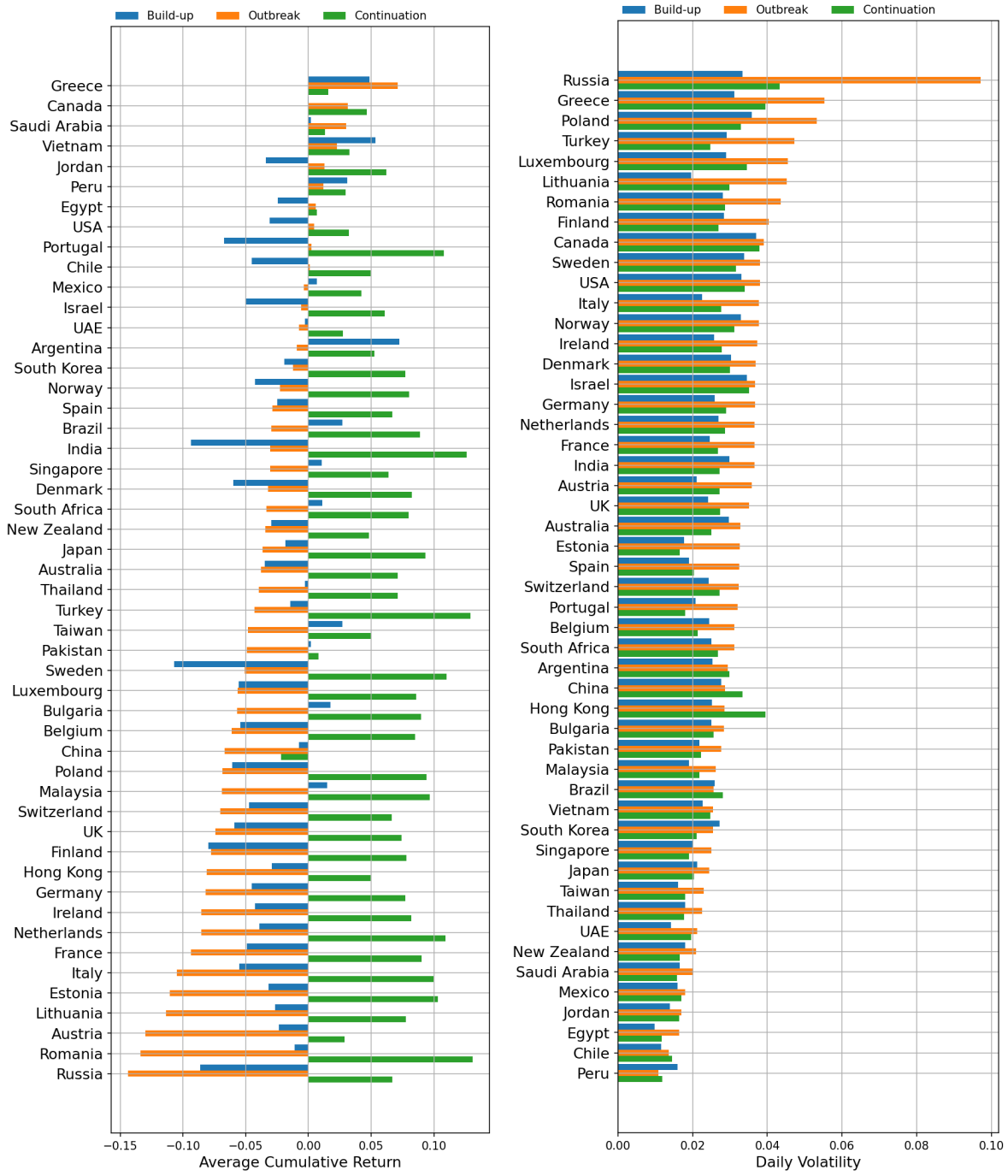
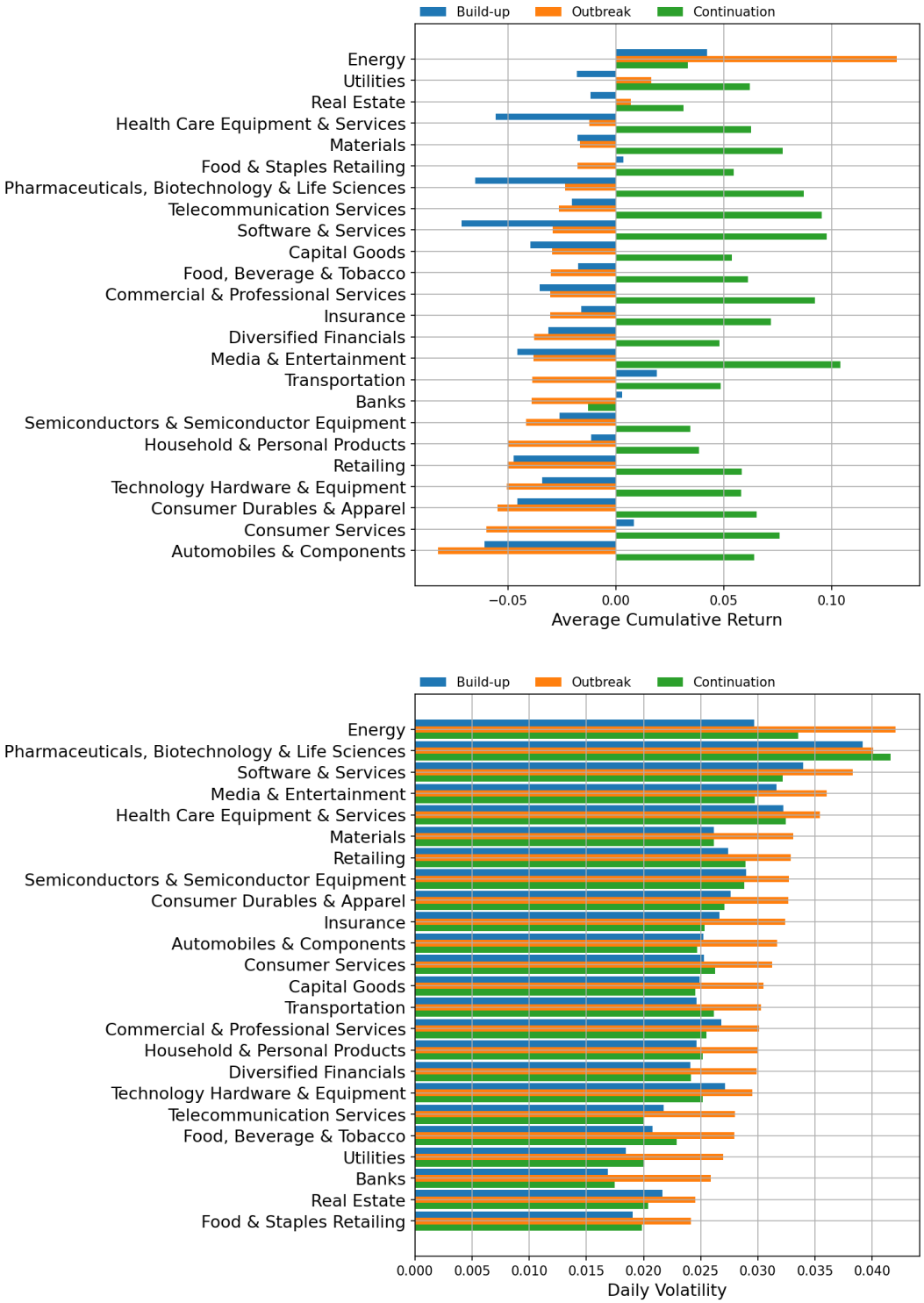


**Figure 3: Stock Market Reaction across Industries**

This figure plots the market reaction of different GICS industries for three periods: Build-up (January 24 - February 23), Outbreak (February 24 - March 08), and Continuation (March 09 - March 31). The upper figure shows the equally weighted cumulative stock returns. The lower figure shows the average standard deviation of daily stock returns.



## Figure 4: Evolution of Coefficients for Transition and Physical Risk

This figure plots the evolution of coefficients for transition and physical risk from the cross-sectional regression with 90% confidence intervals. The upper, middle, and lower graph display the results from the global, US, and Europe sample respectively. The dependent variable is the cumulative return starting from January 24 through each trading day on the horizontal axis. The control variables include firm characteristics, country fixed effects, and industry fixed effects.

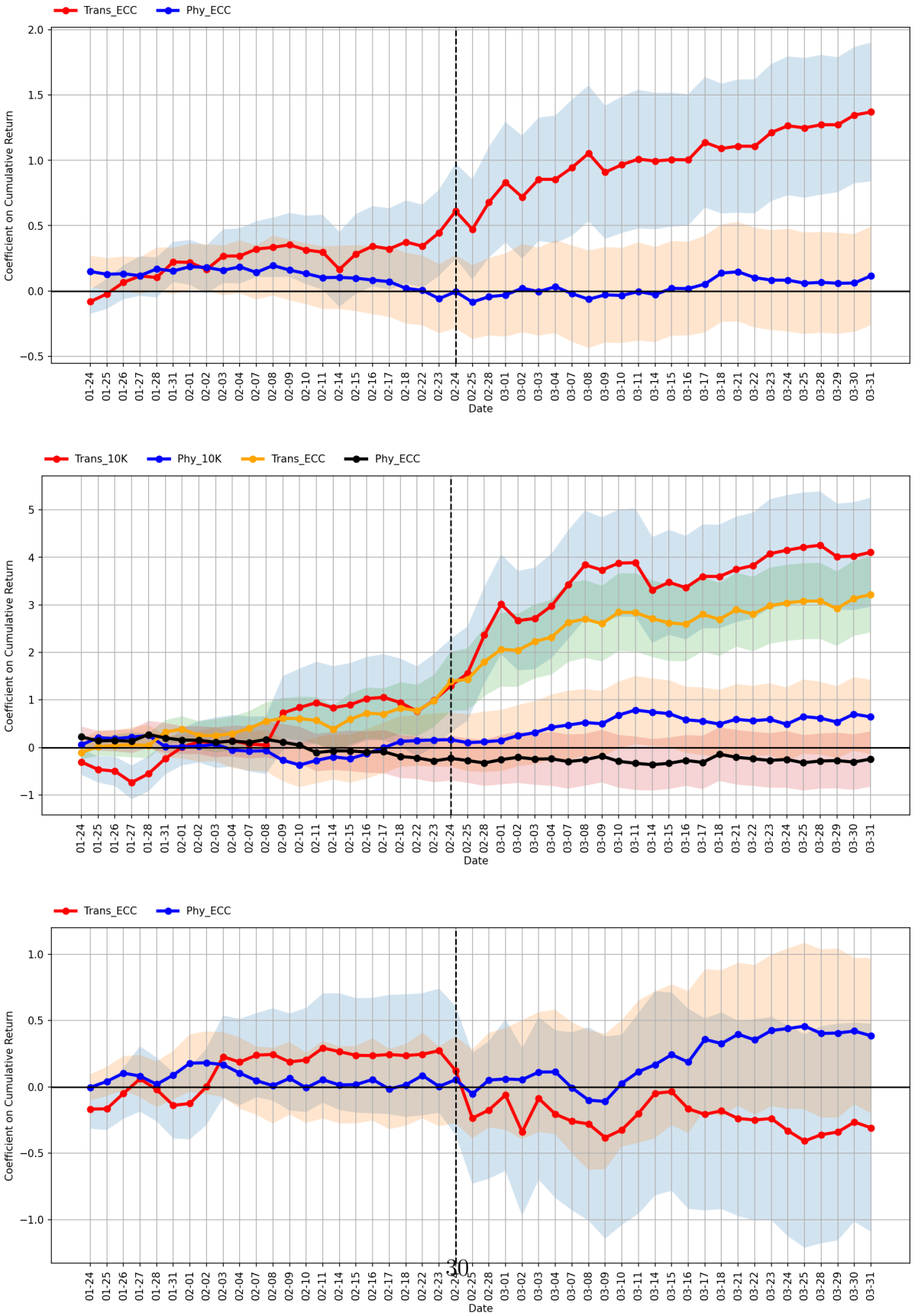


**Figure 5: Evolution of Coefficients for ESG Scores**

This figure plots the evolution of coefficients for different *ESG* scores from the cross-sectional regression with 90% confidence intervals. The ESG measures from Refinitiv, Bloomberg, MSCI, and S&P Global are performance measures. The ESG measures from Sustainalytics and RepRisk are risk measures, i.e., they capture firms' risk exposure to ESG-related topics. The dependent variable is the cumulative return starting from January 24 through each trading day on the horizontal axis. The control variables include firm characteristics, country fixed effects, and industry fixed effects.

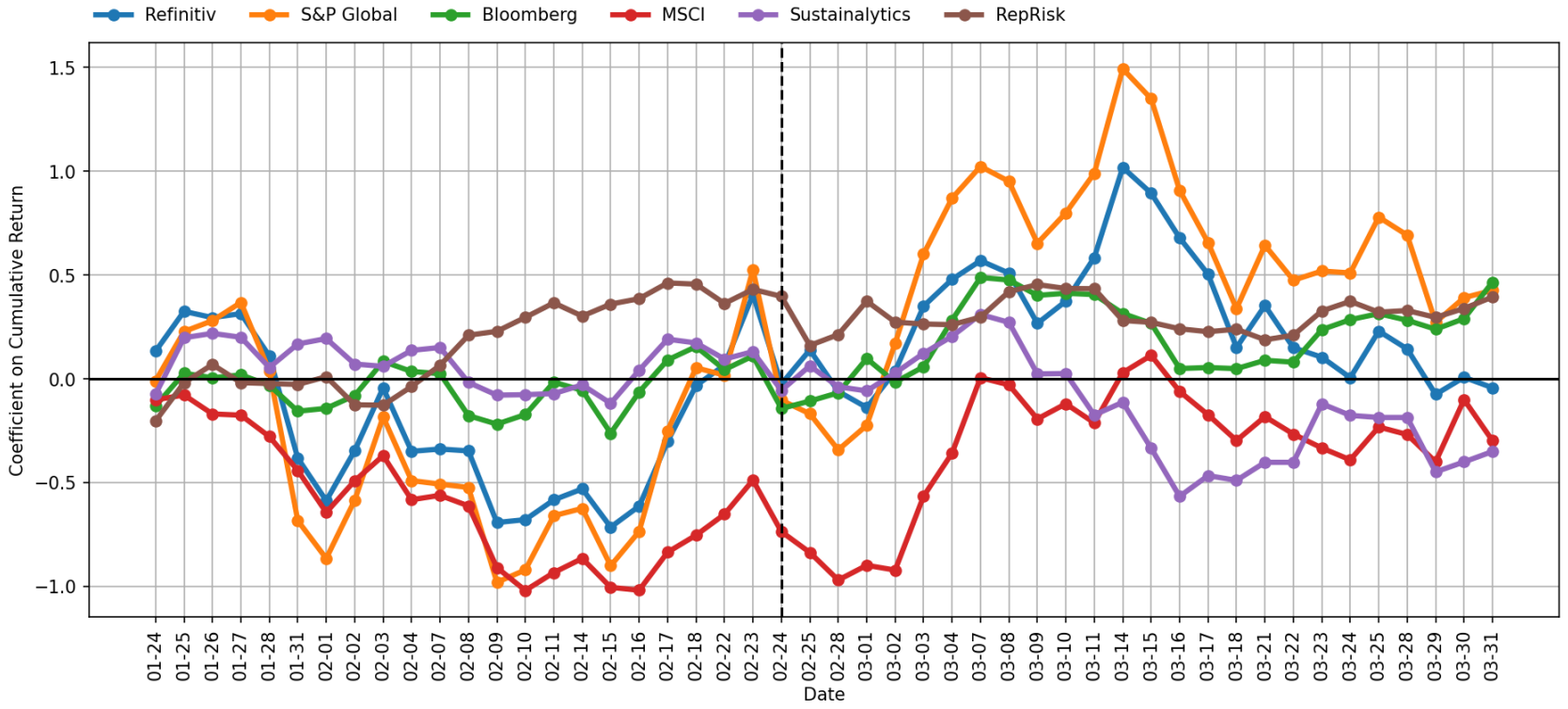


**Figure 6: Evolution of Coefficients for Inflation and International Exposure**

This figure plots the evolution of coefficients for $\%INF$, $\%War$, and $\#China$ from the cross-sectional regression with 90% confidence intervals. The dependent variable is the cumulative return starting from January 24 through each trading day on the horizontal axis. The control variables include firm characteristics, country fixed effects, and industry fixed effects.

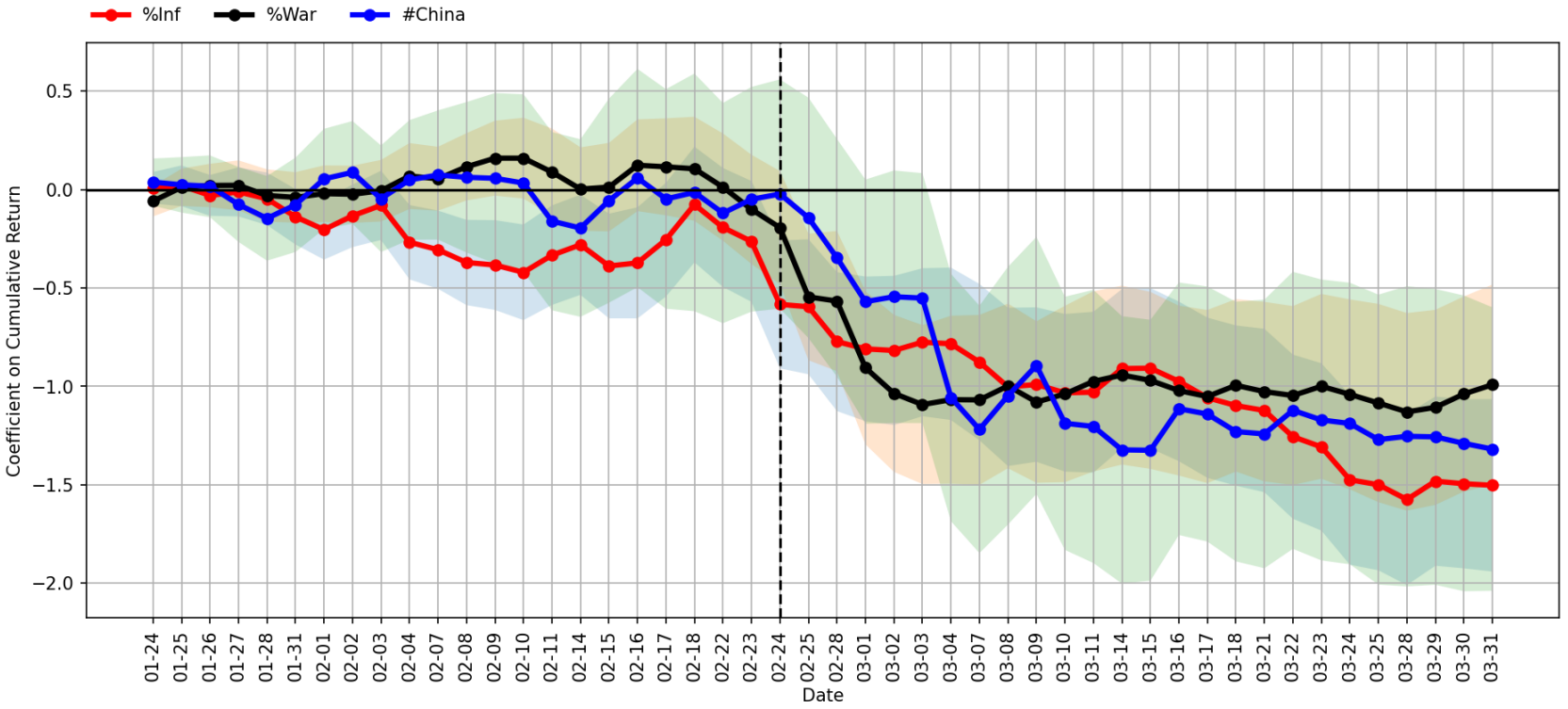


**Table 1: Summary Statistics**

This table reports the summary statistics (number of observations, mean, standard deviation, minimum, 25% 50%, 75% percentiles, and maximum) for the main variables used in the paper. The definition of variables can be found in Appendix A1.

| | N | Mean | Std | Min | 25% | 50% | 75% | Max |
|---|---|---|---|---|---|---|---|---|
| **Stock Returns** | | | | | | | | |
| $Ret^{Buildup}$ | 3536 | -0.0282 | 0.1126 | -0.3282 | -0.0910 | -0.0307 | 0.0294 | 0.3452 |
| $Ret^{Outbreak}$ | 3536 | -0.0134 | 0.1190 | -0.2947 | -0.0851 | -0.0227 | 0.0403 | 0.4098 |
| $Ret^{Continuation}$ | 3528 | 0.0461 | 0.1156 | -0.2674 | -0.0214 | 0.0416 | 0.1092 | 0.4433 |
| **Basic Firm Characteristics** | | | | | | | | |
| $\beta^{MKT}$ | 3536 | 0.9254 | 0.3943 | -0.1173 | 0.6672 | 0.9307 | 1.1921 | 1.8628 |
| $Size$ | 3536 | 8.0981 | 1.7656 | 4.3966 | 6.8179 | 8.0597 | 9.3190 | 12.3466 |
| $BTM$ | 3536 | -1.0983 | 0.9975 | -4.3778 | -1.6623 | -0.9660 | -0.3737 | 0.8103 |
| $ROA$ | 3536 | 0.0104 | 0.0626 | -0.2405 | -0.0022 | 0.0115 | 0.0358 | 0.1996 |
| $Cash$ | 3536 | 0.1909 | 0.2160 | 0.0015 | 0.0465 | 0.1106 | 0.2424 | 0.9335 |
| $Leverage$ | 3536 | 1.2361 | 2.1097 | 0.0000 | 0.2467 | 0.6280 | 1.2940 | 14.6274 |
| **Climate Risk Exposure** | | | | | | | | |
| $Trans^{ECC}$ | 3536 | 2.5890 | 5.5669 | 0.0000 | 0.0000 | 0.0000 | 2.4481 | 30.8946 |
| $Phy^{ECC}$ | 3536 | 0.1409 | 0.5279 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 3.5023 |
| $Trans^{10K}$ | 1694 | 0.0522 | 0.0859 | 0.0000 | 0.0022 | 0.0191 | 0.0586 | 0.4382 |
| $Phy^{10K}$ | 1694 | 0.0198 | 0.0216 | 0.0000 | 0.0033 | 0.0134 | 0.0289 | 0.1053 |
| **ESG Measures** | | | | | | | | |
| $ESG^{Refinitiv}$ | 3536 | 46.3711 | 19.1199 | 9.1100 | 31.2275 | 45.7400 | 61.0625 | 86.2200 |
| $E^{Refinitiv}$ | 3532 | 35.9453 | 30.1145 | 0.0000 | 4.4250 | 33.6350 | 62.3075 | 93.6800 |
| $S^{Refinitiv}$ | 3533 | 51.6775 | 22.4322 | 8.9900 | 33.2800 | 50.8700 | 70.1000 | 94.2500 |
| $G^{Refinitiv}$ | 3536 | 53.2952 | 22.2548 | 6.5800 | 36.2300 | 55.0000 | 71.1675 | 93.6100 |
| $ESG^{Bloomberg}$ | 2952 | 0.7622 | 1.7224 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 6.2100 |
| $ESG^{MSCI}$ | 987 | 6.4169 | 1.8185 | 2.1430 | 5.0000 | 6.4285 | 7.8570 | 9.2855 |
| $ESG^{S\&PGlobal}$ | 2952 | 45.4668 | 29.4801 | 0.0000 | 21.0000 | 43.0000 | 70.0000 | 100.0000 |
| $ESG^{Sustainalytics}$ | 2952 | 7.8669 | 11.2130 | 0.0000 | 0.0000 | 0.0000 | 17.6757 | 36.1760 |
| $ESG^{RepRisk}$ | 2258 | 13.3911 | 12.8027 | 0.0000 | 0.0000 | 14.0000 | 22.0000 | 55.0000 |
| **Inflation Exposure** | | | | | | | | |
| $\%INF$ | 3536 | 1.7099 | 3.2821 | 0.0000 | 0.0000 | 0.3199 | 1.8401 | 17.7982 |
| **International Exposure** | | | | | | | | |
| $\%War$ | 3536 | 0.1899 | 0.6037 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 4.1637 |
| $\#China$ | 1690 | 7.7982 | 15.4773 | 0.0000 | 0.0000 | 0.0000 | 8.0000 | 89.0000 |
| $\#Russia$ | 1690 | 1.2580 | 3.7742 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 22.0000 |
| $\#Ukraine$ | 1690 | 0.6651 | 2.4083 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 15.0000 |
| $\mathbb{1}_{Action}$ | 3536 | 0.0650 | 0.2466 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| $\mathbb{1}_{Active}$ | 3536 | 0.0037 | 0.0605 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| $IntSale$ | 3536 | 0.3213 | 0.3810 | 0.0000 | 0.0000 | 0.1033 | 0.6538 | 1.0000 |
| $\mathbb{1}_{IntSaleNA}$ | 3536 | 0.4296 | 0.4951 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 1.0000 |

## Table 2: Cross Sectional Regressions of Cumulative Returns

This table summarizes the results of cross-sectional regressions of cumulative stock returns. The dependent variables are the total returns in the three periods (Build-up, Outbreak, and Continuation). The explanatory variables include proxies for firms' transition and physical risk, inflation exposure, international exposure, and various firm characteristics. Country and industry fixed effects are included as control variables. All continuous explanatory variables are winsorized at the 1 percent and 99 percent levels and standardized to have zero mean and unit variance. All variables are defined in Table A1. The t-statistics (based on robust standard errors) are reported in parentheses below the coefficient estimates. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ret^{Buildup}$ | | | $Ret^{Outbreak}$ | | | $Ret^{Continuation}$ | |
| $Trans^{ECC}$ | 0.440** | 0.792* | | 0.404* | 1.576*** | | 0.442** | 0.407 | |
| | (2.26) | (1.94) | | (1.72) | (3.57) | | (2.14) | (1.01) | |
| $Phy^{ECC}$ | -0.0586 | -0.492* | | 0.0136 | -0.0169 | | 0.191 | 0.0963 | |
| | (-0.38) | (-1.75) | | (0.09) | (-0.06) | | (1.27) | (0.39) | |
| $Trans^{10K}$ | | | 0.823 | | | 3.009*** | | | 0.720* |
| | | | (1.63) | | | (5.93) | | | (1.82) |
| $Phy^{10K}$ | | | 0.215 | | | 0.449 | | | 0.459 |
| | | | (0.67) | | | (1.50) | | | (1.50) |
| $ESG^{Refinitiv}$ | 0.423* | 0.146 | 0.138 | 0.00183 | 0.0381 | 0.167 | -0.480* | -0.266 | -0.333 |
| | (1.71) | (0.39) | (0.37) | (0.01) | (0.12) | (0.54) | (-1.93) | (-0.76) | (-0.95) |
| $\%INF$ | -0.241 | -0.321 | -0.436 | -0.886*** | -1.025*** | -1.180*** | -0.325* | -0.172 | -0.228 |
| | (-1.29) | (-1.20) | (-1.64) | (-5.18) | (-4.39) | (-4.84) | (-1.70) | (-0.68) | (-0.92) |
| $\%War$ | -0.113 | 0.521 | 0.516 | -0.920*** | -0.721* | -0.729* | 0.412* | 0.875 | 0.842 |
| | (-0.65) | (1.52) | (1.50) | (-4.34) | (-1.76) | (-1.86) | (1.75) | (1.58) | (1.51) |
| $\#Russia$ | | -0.453 | -0.437 | | 0.0607 | 0.0593 | | 0.179 | 0.280 |
| | | (-1.08) | (-1.03) | | (0.17) | (0.17) | | (0.44) | (0.67) |
| $\#Ukraine$ | | 0.194 | 0.198 | | 0.000510 | 0.0222 | | 0.412 | 0.348 |
| | | (0.49) | (0.50) | | (0.00) | (0.07) | | (1.03) | (0.86) |
| $\#China$ | | 0.0439 | 0.0521 | | -1.036*** | -1.053*** | | -0.474 | -0.558* |
| | | (0.12) | (0.15) | | (-3.46) | (-3.84) | | (-1.41) | (-1.67) |
| $\mathbb{1}_{Action}$ | -0.167 | 0.100 | 0.261 | -3.060*** | -2.322*** | -2.018** | -0.695 | -1.081 | -1.042 |
| | (-0.22) | (0.09) | (0.23) | (-4.91) | (-2.71) | (-2.39) | (-1.00) | (-1.11) | (-1.08) |
| $\mathbb{1}_{Active}$ | 2.328 | 4.026 | 3.782 | -2.390 | -1.038 | -1.667 | 1.115 | 0.648 | 0.289 |
| | (1.16) | (1.22) | (1.13) | (-0.97) | (-0.44) | (-0.65) | (0.52) | (0.19) | (0.09) |
| $\beta^{MKT}$ | 0.362 | 0.422 | 0.475 | -0.869*** | -1.302*** | -1.126*** | -0.0368 | -1.261** | -1.189** |
| | (1.17) | (0.83) | (0.94) | (-3.20) | (-3.05) | (-2.66) | (-0.12) | (-2.47) | (-2.35) |
| $Size$ | -0.583* | -0.760 | -0.746 | -0.556* | -1.553*** | -1.741*** | 2.783*** | 3.588*** | 3.656*** |
| | (-1.69) | (-1.39) | (-1.37) | (-1.80) | (-3.33) | (-3.80) | (8.10) | (6.61) | (6.80) |
| $BTM$ | 0.734** | 0.182 | 0.213 | 0.0954 | -0.463 | -0.516 | -0.560* | -0.681 | -0.655 |
| | (2.45) | (0.40) | (0.47) | (0.36) | (-1.13) | (-1.29) | (-1.89) | (-1.57) | (-1.52) |
| $ROA$ | 2.502*** | 1.947** | 2.018** | -0.0237 | 0.454 | 0.540 | -0.0269 | -0.186 | -0.0494 |
| | (5.58) | (2.03) | (2.13) | (-0.06) | (0.66) | (0.77) | (-0.05) | (-0.18) | (-0.05) |
| $Cash$ | -0.607* | -0.197 | -0.160 | -0.325 | -0.553 | -0.413 | 0.993*** | 1.798*** | 1.968*** |
| | (-1.88) | (-0.39) | (-0.32) | (-1.15) | (-1.51) | (-1.14) | (2.97) | (3.50) | (3.83) |
| $Leverage$ | 0.353* | 0.215 | 0.182 | -0.363** | -0.442** | -0.511** | 0.150 | -0.230 | -0.262 |
| | (1.75) | (0.77) | (0.66) | (-2.31) | (-2.13) | (-2.41) | (0.71) | (-0.92) | (-1.06) |
| $Ret^{Buildup}$ | | | | 0.0835 | -0.238 | -0.235 | | | |
| | | | | (0.38) | (-0.81) | (-0.82) | | | |
| $Ret^{Outbreak}$ | | | | | | | -0.899*** | -0.283 | -0.316 |
| | | | | | | | (-3.86) | (-0.75) | (-0.81) |
| Constant | 8.087 | -12.10*** | -11.79*** | -7.536** | -4.159 | -3.783 | 12.81*** | 17.66*** | 17.96*** |
| | (0.76) | (-3.48) | (-3.37) | (-2.52) | (-1.29) | (-1.21) | (2.64) | (6.57) | (6.65) |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Std Error | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust |
| Observations | 3536 | 1690 | 1709 | 3536 | 1690 | 1709 | 3528 | 1687 | 1706 |
| R-squared | 0.143 | 0.115 | 0.117 | 0.317 | 0.290 | 0.310 | 0.177 | 0.214 | 0.217 |

## Table 3: Cross-sectional Regressions of Cumulative Returns: US and Europe

This table summarizes the results of cross-sectional regressions of cumulative stock returns for three different samples, i.e., global firms, US firms, and European firms. The dependent variables are the total returns for the three periods (Build-up, Outbreak, and Continuation). The explanatory variables include proxies for firms' transition and physical risk, inflation exposure, international exposure, and various firm characteristics. Country and industry fixed effects are included as control variables. All continuous variables are winsorized at the 1 percent and 99 percent levels and standardized to have zero mean and unit variance. All variables are defined in Table A1. The t-statistics (based on robust standard errors) are reported in parentheses below the coefficient estimates. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ret^{Buildup}$ | | | $Ret^{Outbreak}$ | | | $Ret^{Continuation}$ | |
| | Global | US | Europe | Global | US | Europe | Global | US | Europe |
| $Trans^{ECC}$ | 0.440** | 1.036*** | 0.114 | 0.404* | 1.508*** | -0.671* | 0.442** | 0.538 | 0.0681 |
| | (2.26) | (3.25) | (0.41) | (1.72) | (4.29) | (-1.93) | (2.14) | (1.55) | (0.21) |
| $Phy^{ECC}$ | -0.0586 | -0.321 | 0.0262 | 0.0136 | 0.0803 | -0.113 | 0.191 | 0.0175 | 0.398 |
| | (-0.38) | (-1.26) | (0.14) | (0.09) | (0.37) | (-0.51) | (1.27) | (0.08) | (1.53) |
| $ESG^{Refinitiv}$ | 0.423* | 0.352 | 0.134 | 0.00183 | 0.00248 | -1.012** | -0.480* | -0.406 | -0.286 |
| | (1.71) | (1.07) | (0.30) | (0.01) | (0.01) | (-2.09) | (-1.93) | (-1.25) | (-0.50) |
| $\%INF$ | -0.241 | -0.172 | -0.518 | -0.886*** | -1.028*** | -0.664** | -0.325* | -0.251 | -0.761* |
| | (-1.29) | (-0.70) | (-1.61) | (-5.18) | (-4.78) | (-2.14) | (-1.70) | (-1.06) | (-1.76) |
| $\%War$ | -0.113 | -0.142 | -0.190 | -0.920*** | -0.780** | -1.353*** | 0.412* | 0.957** | 0.0106 |
| | (-0.65) | (-0.43) | (-0.87) | (-4.34) | (-2.20) | (-4.98) | (1.75) | (2.07) | (0.03) |
| $\mathbb{1}_{Action}$ | -0.167 | 0.181 | -2.260** | -3.060*** | -2.722*** | -3.985*** | -0.695 | -0.796 | 0.0926 |
| | (-0.22) | (0.18) | (-2.04) | (-4.91) | (-3.22) | (-3.49) | (-1.00) | (-0.88) | (0.07) |
| $\mathbb{1}_{Active}$ | 2.328 | 2.983 | 0.747 | -2.390 | -1.990 | -0.476 | 1.115 | -0.0282 | 0.636 |
| | (1.16) | (1.04) | (0.24) | (-0.97) | (-0.82) | (-0.07) | (0.52) | (-0.01) | (0.32) |
| $\beta^{MKT}$ | 0.362 | 0.489 | 0.171 | -0.869*** | -0.723** | -1.138 | -0.0368 | -0.504 | 0.105 |
| | (1.17) | (1.20) | (0.28) | (-3.20) | (-2.18) | (-1.63) | (-0.12) | (-1.20) | (0.16) |
| $Size$ | -0.583* | -1.237*** | 1.480** | -0.556* | -1.070*** | 0.869 | 2.783*** | 3.210*** | 0.0681 |
| | (-1.69) | (-2.78) | (2.26) | (-1.80) | (-2.78) | (1.22) | (8.10) | (7.22) | (0.10) |
| $BTM$ | 0.734** | -0.0779 | 2.526*** | 0.0954 | -0.0390 | 0.367 | -0.560* | -0.690* | -0.908 |
| | (2.45) | (-0.21) | (5.03) | (0.36) | (-0.11) | (0.61) | (-1.89) | (-1.85) | (-1.54) |
| $ROA$ | 2.502*** | 3.397*** | 2.296*** | -0.0237 | 0.197 | -0.00758 | -0.0269 | 0.634 | -0.225 |
| | (5.58) | (4.29) | (4.33) | (-0.06) | (0.36) | (-0.01) | (-0.05) | (0.77) | (-0.33) |
| $Cash$ | -0.607* | -0.511 | -0.412 | -0.325 | -0.393 | 0.801 | 0.993*** | 1.359*** | 0.225 |
| | (-1.88) | (-1.26) | (-0.62) | (-1.15) | (-1.19) | (1.00) | (2.97) | (3.40) | (0.29) |
| $Leverage$ | 0.353* | 0.0506 | 1.315*** | -0.363** | -0.255 | -0.651 | 0.150 | -0.0294 | -0.0372 |
| | (1.75) | (0.21) | (3.16) | (-2.31) | (-1.35) | (-1.47) | (0.71) | (-0.13) | (-0.07) |
| $Ret^{Buildup}$ | | | | 0.0835 | -0.0478 | 0.339 | | | |
| | | | | (0.38) | (-0.19) | (0.63) | | | |
| $Ret^{Outbreak}$ | | | | | | | -0.899*** | -0.382 | -1.797*** |
| | | | | | | | (-3.86) | (-1.28) | (-4.06) |
| Constant | 8.087 | -3.776 | -5.915* | -7.536** | -3.971 | -24.72*** | 12.81*** | -3.120 | -5.175* |
| | (0.76) | (-1.35) | (-1.86) | (-2.52) | (-1.42) | (-9.12) | (2.64) | (-1.49) | (-1.69) |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Std Error | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust |
| Observations | 3536 | 2294 | 746 | 3536 | 2294 | 746 | 3528 | 2288 | 745 |
| R-squared | 0.143 | 0.112 | 0.247 | 0.317 | 0.239 | 0.393 | 0.177 | 0.163 | 0.175 |

## Table 4: Robustness: Different ESG Measures

This table summarizes the results of cross-sectional regressions of cumulative stock returns on different ESG measures. The dependent variables are the total returns for the three periods (Build-up, Outbreak, and Continuation). The explanatory variables include firms' transition and physical risk, inflation exposure, international exposure, and various firm characteristics, but only the coefficients for ESG, transition risk, and physical risk are displayed. Country and industry fixed effects are included as control variables. All continuous variables are winsorized at the 1 percent and 99 percent levels and standardized to have zero mean and unit variance. All variables are defined in Table A1. The t-statistics (based on robust standard errors) are reported in parentheses below the coefficient estimates. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ret^{Buildup}$ | | | $Ret^{Outbreak}$ | | | $Ret^{Continuation}$ | |
| Sample | ECC | ECC+10K | 10K | ECC | ECC+10K | 10K | ECC | ECC+10K | 10K |
| Climate Risk Measure | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ |
| Panel A: S&P Global | | | | | | | | | |
| *Trans* | 0.469** | 0.831** | 0.775* | 0.402* | 1.475*** | 3.039*** | 0.359* | 0.288 | 0.585 |
| | (2.37) | (2.20) | (1.69) | (1.69) | (3.60) | (6.15) | (1.85) | (0.83) | (1.54) |
| *Phy* | -0.0805 | -0.553** | 0.292 | 0.0359 | -0.0519 | 0.444 | 0.253 | 0.224 | 0.382 |
| | (-0.51) | (-2.14) | (1.01) | (0.23) | (-0.19) | (1.55) | (1.63) | (0.91) | (1.30) |
| $ESG^{S\&PGlobal}$ | 0.518 | -0.0180 | 0.0686 | 0.492* | 0.613 | 0.666* | -0.439 | -0.204 | -0.200 |
| | (1.63) | (-0.04) | (0.14) | (1.74) | (1.55) | (1.72) | (-1.45) | (-0.45) | (-0.45) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 3122 | 1648 | 1669 | 3122 | 1648 | 1669 | 3114 | 1646 | 1667 |
| Panel B: Bloomberg | | | | | | | | | |
| *Trans* | 0.473** | 0.815** | 0.749 | 0.389 | 1.497*** | 3.023*** | 0.327* | 0.221 | 0.487 |
| | (2.37) | (2.16) | (1.63) | (1.62) | (3.65) | (6.18) | (1.68) | (0.64) | (1.28) |
| *Phy* | -0.0649 | -0.541** | 0.296 | 0.0570 | -0.0175 | 0.453 | 0.250 | 0.265 | 0.392 |
| | (-0.41) | (-2.09) | (1.02) | (0.36) | (-0.07) | (1.57) | (1.59) | (1.08) | (1.33) |
| $ESG^{Bloomberg}$ | 0.307 | 0.212 | 0.172 | 0.470* | 0.644 | 0.253 | 0.0285 | 0.712** | 0.575* |
| | (1.28) | (0.54) | (0.43) | (1.78) | (1.59) | (0.69) | (0.12) | (2.11) | (1.68) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 3122 | 1648 | 1669 | 3122 | 1648 | 1669 | 3114 | 1646 | 1667 |
| Panel C: MSCI | | | | | | | | | |
| *Trans* | 0.238 | 0.806 | 0.748 | 0.179 | 0.968* | 2.545*** | 0.600*** | 0.610 | 0.698 |
| | (1.04) | (1.55) | (1.18) | (0.78) | (1.78) | (2.90) | (2.64) | (1.42) | (1.42) |
| *Phy* | 0.201 | -0.648** | -0.134 | 0.0433 | -0.464 | 0.0271 | 0.253 | 0.606 | 0.633* |
| | (1.00) | (-2.16) | (-0.29) | (0.21) | (-1.07) | (0.06) | (1.14) | (1.61) | (1.74) |
| $ESG^{MSCI}$ | -0.545 | -0.790 | -0.871* | 0.433 | 1.227*** | 1.324*** | -0.183 | -0.403 | -0.395 |
| | (-1.62) | (-1.53) | (-1.71) | (1.33) | (2.74) | (2.98) | (-0.62) | (-1.04) | (-1.03) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 1009 | 435 | 439 | 1009 | 435 | 439 | 1009 | 435 | 439 |
| Panel D: Sustainalytics | | | | | | | | | |
| *Trans* | 0.503** | 0.827** | 0.782* | 0.434* | 1.542*** | 3.065*** | 0.333* | 0.267 | 0.579 |
| | (2.53) | (2.18) | (1.70) | (1.82) | (3.74) | (6.21) | (1.72) | (0.78) | (1.52) |
| *Phy* | -0.0762 | -0.557** | 0.289 | 0.0401 | -0.0521 | 0.447 | 0.251 | 0.226 | 0.382 |
| | (-0.48) | (-2.16) | (0.99) | (0.26) | (-0.19) | (1.56) | (1.60) | (0.92) | (1.29) |
| $ESG^{Sustainalytics}$ | 0.0764 | -0.203 | -0.186 | 0.0744 | 0.0643 | -0.0508 | -0.244 | 0.0619 | 0.0111 |
| | (0.27) | (-0.47) | (-0.43) | (0.26) | (0.15) | (-0.13) | (-0.82) | (0.15) | (0.03) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 3122 | 1648 | 1669 | 3122 | 1648 | 1669 | 3114 | 1646 | 1667 |
| Panel E: RepRisk | | | | | | | | | |
| *Trans* | 0.548** | 0.994** | 0.651 | 0.237 | 1.401*** | 2.708*** | 0.433* | 0.727 | 0.996** |
| | (2.44) | (2.07) | (1.12) | (0.95) | (2.77) | (4.84) | (1.80) | (1.48) | (2.15) |
| *Phy* | -0.167 | -0.827** | 0.228 | -0.166 | -0.212 | 0.513 | 0.0841 | 0.163 | 0.632* |
| | (-0.89) | (-2.21) | (0.57) | (-0.94) | (-0.62) | (1.39) | (0.46) | (0.54) | (1.71) |
| $ESG^{RepRisk}$ | 0.391 | 0.639* | 0.606 | 0.113 | -0.0712 | -0.189 | 0.113 | 0.0918 | 0.0215 |
| | (1.61) | (1.74) | (1.64) | (0.49) | (-0.20) | (-0.56) | (0.47) | (0.27) | (0.06) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 2406 | 1086 | 1094 | 2406 | 1086 | 1094 | 2400 | 1085 | 1093 |

# Appendices

**Table A1: Variable Definitions**

| Variable | Definition | Source |
|---|---|---|
| $\mathbb{1}_{Action}$ | A dummy variable indicating whether a firm has taken any of the following action regarding their business in Russia: holding off new investments/development, reducing current operations, suspension, withdraw. | Jeffrey Sonnenfeld and Yale Research Team |
| $\mathbb{1}_{Active}$ | A dummy variable indicating whether a firm has not been taking any action regarding their business in Russia. | Jeffrey Sonnenfeld and Yale Research Team |
| $\beta^{MKT}$ | The coefficient of the market return calculated from the Fama-French five-factor model plus momentum factor with prior one year daily data for developed regions, or 5 years monthly data for developing regions, by the end of calendar year 2021. | Compustat, Fama and French (2015) |
| $BTM$ | The natural logarithm of the firm's book-to-market ratio (book equity divided by market capitalization), measured by the end of calendar year 2021. | Compustat |
| $Cash$ | Cash and short-term investments divided by total assets, measured by the end of calendar year 2021. | Compustat |
| $\#Country$ | $\#Russia$, $\#Ukraine$, $\#China$ The number of times a firm mentions Russia, Ukraine, or China in their 10-K regarding offshore activities. | 10-K, Hoberg and Moon (2017), own calculations |

**Table A1 Continued**

| | | |
|---|---|---|
| $ESG^{Refinitiv}$ | ESG measure from Refinitiv, an overall company score based on the reported information in the environmental, social and corporate governance pillars (ESG Score) with an ESG Controversies overlay, measured by the end of calendar year 2021. | Refinitiv Eikon |
| $ESG^{Bloomberg}$ | ESG measure from Bloomberg, an ESG score raging from 0 to 10 evaluating the company's aggregated Environmental, Social and Governance (ESG) performance. | Bloomberg Terminal |
| $ESG^{MSCI}$ | ESG measure from MSCI, an ESG rating categorized in letters from best (AAA) to worst (CCC). We transform the letter rating into numerical value based on the rating methodology provided by MSCI. We take the average of the range of the final industy-adjusted company score of each letter rating category as the numerical value for that category. | Bloomberg Terminal |
| $ESG^{S\&PGlobal}$ | ESG measure from S&P Global, a sustainability percentile rank converted from a total sustainability score which ranges from 0-100. | Bloomberg Terminal |
| $ESG^{Sustainalytics}$ | ESG measure from Sustainalytics. It captures the company's overall score in the ESG Risk Rating. The score ranges from 0 and 100, with 0 indicating the risks have been fully managed and 100 indicating the highest level of unmanaged risk. | Bloomberg Terminal |
| $ESG^{RepRisk}$ | ESG measure from RepRisk, an index that captures a firm's exposure to reputational risks related to ESG. The value ranges from zero (lowers) to 100 (highest). The higher the value, the higher the risk exposure. | WRDS |

**Table A1 Continued**

| | | |
|---|---|---|
| $E/S/G$ | The environment/social/governance pillar score from Refinitiv, which is the weighted average relative performance of a company based on the reported environment/social/governance information and the resulting environment/social/governance category scores, measured by the end of calendar year 2021. | Refinitiv Eikon |
| $\%INF$ | The total number of keywords (INFLATION, CPI, PPI) divided by the total number of words in earnings conference calls, then averaged for each firm for the calendar year 2021. | Refinitiv Company Events Coverage |
| $IntSale$ | The percentage of revenues generated from international sales, measured at the end of calendar year 2021. | S&P Global Capital IQ |
| $\mathbb{1}_{IntSaleNA}$ | A dummy variable indicating whether a firm is missing international revenues information. | S&P Global Capital IQ |
| $Leverage$ | Long-term debt plus debt in current liabilities divided by total assets, measured at the end of calendar year 2021. | Compustat |
| $Phy^{10K}$ | The physical risk score generated from 10-K using a machine learning approach based on BERT. | 10-K, Kölbel et al. (2020) |
| $Phy^{ECC}$ | The physical risk score generated from earnings conference call transcripts using a machine learning and bigram matching approach.[19] | Sautner et al. (2020) |
| $Ret$ | $Ret^{Buildup}$, $Ret^{Outbreak}$, $Ret^{Continuation}$. The total return for the Buildup (January 24, 2022 through February 23, 2022), Outbreak (February 24, 2022 through March 08, 2022) and Continuation (March 09, 2022 through March 31, 2022) periods, respectively. | Compustat |
| $ROA$ | Return on assets, calculated as income before extraordinary items divided by total assets, measured by the end of calendar year 2021. | Compustat |

[19]The variable name in the original data file provided by the authors is $ph\_expo\_ew$.

**Table A1 Continued**

| | | |
|---|---|---|
| $Size$ | The natural logarithm of the firm's market capitalization (in millions), measured at the end of calendar year 2021. | Compustat |
| $Trans^{10K}$ | The transition risk score generated from 10-Ks using a machine learning approach based on BERT. | 10-K, Kölbel et al. (2020) |
| $Trans^{ECC}$ | The transition risk score generated from earnings conference call transcripts using a machine learning and bigram matching approach.[20] | Sautner et al. (2020) |
| $\%War$ | The total number of war-relevant keywords (RUSSIA, RUSSIAN, UKRAINE, UKRAINIAN, WAR) divided by the total number of words in an earnings conference call, then averaged for each firm during the period of January 01, 2021 through February 24, 2022.[21] | Refinitiv Company Events Coverage |

[20]The variable name in the original data file provided by the authors is $rg\_expo\_ew$.

[21]The measures generated from the earnings conference calls ($\%INF$, $\%War$, $Trans^{ECC}$, $Phy^{ECC}$) are relatively small because of the scaling method. Due to the precision limit of the value in the summary statistics table, we have adjusted the original variable of $\%INF$ by a factor of 100 and $Trans^{ECC}$, $Phy^{ECC}$, $\%War$ by a factor of 10,000 for better presentation of the variation. The regressions use standardized values for all explanatory variables.

**Table A2: Country/Region Distribution**

| Country/Region | Return Sample | Global Sample | Europe Sample |
|---|---|---|---|
| Argentina | 19 | 2 | 0 |
| Australia | 335 | 154 | 0 |
| Austria | 22 | 13 | 13 |
| Bahamas | 0 | 1 | 0 |
| Belgium | 41 | 19 | 19 |
| Bermuda | 0 | 19 | 0 |
| Brazil | 97 | 4 | 0 |
| Bulgaria | 32 | 0 | 0 |
| Canada | 241 | 98 | 0 |
| Cayman Islands | 0 | 4 | 0 |
| Chile | 25 | 0 | 0 |
| China | 854 | 5 | 0 |
| Colombia | 0 | 1 | 0 |
| Czech Republic | 0 | 2 | 0 |
| Denmark | 77 | 34 | 34 |
| Egypt | 32 | 0 | 0 |
| Estonia | 12 | 0 | 0 |
| Finland | 130 | 39 | 39 |
| France | 211 | 66 | 66 |
| Germany | 123 | 54 | 54 |
| Greece | 28 | 3 | 3 |
| Hong Kong | 71 | 19 | 0 |
| India | 1533 | 3 | 0 |
| Ireland | 44 | 27 | 27 |
| Israel | 102 | 21 | 0 |
| Italy | 82 | 13 | 13 |
| Japan | 3009 | 90 | 0 |
| Jordan | 15 | 0 | 0 |
| Lithuania | 12 | 0 | 0 |
| Luxembourg | 31 | 17 | 17 |
| Malaysia | 59 | 1 | 0 |
| Malta | 0 | 3 | 3 |
| Mexico | 54 | 0 | 0 |
| Monaco | 0 | 4 | 4 |
| Netherlands | 71 | 39 | 39 |
| New Zealand | 58 | 30 | 0 |
| Norway | 147 | 37 | 37 |
| Pakistan | 56 | 0 | 0 |
| Peru | 26 | 0 | 0 |
| Poland | 96 | 0 | 0 |
| Portugal | 13 | 5 | 5 |
| Romania | 16 | 0 | 0 |
| Russia | 19 | 1 | 0 |
| Saudi Arabia | 73 | 0 | 0 |
| Singapore | 54 | 12 | 0 |
| South Africa | 71 | 1 | 0 |
| South Korea | 462 | 15 | 0 |
| Spain | 81 | 32 | 32 |
| Sweden | 442 | 87 | 87 |
| Switzerland | 127 | 60 | 60 |
| Taiwan | 454 | 11 | 0 |
| Thailand | 77 | 0 | 0 |
| Turkey | 148 | 0 | 0 |
| United Arab Emirates | 20 | 0 | 0 |
| United Kingdom | 457 | 194 | 194 |
| United States of America | 4162 | 2294 | 0 |
| Uruguay | 0 | 1 | 0 |
| Vietnam | 172 | 0 | 0 |
| Virgin Islands, U.S. | 0 | 1 | 0 |
| Total | 14593 | 3536 | 746 |

**Table A3: Industry Distribution**

| Industry | Return Sample | Global Sample | Europe Sample |
|---|---|---|---|
| Automobiles & Components | 380 | 58 | 20 |
| Banks | 402 | 177 | 6 |
| Capital Goods | 1970 | 394 | 137 |
| Commercial & Professional Services | 568 | 142 | 44 |
| Consumer Durables & Apparel | 671 | 129 | 32 |
| Consumer Services | 520 | 125 | 25 |
| Diversified Financials | 295 | 94 | 5 |
| Energy | 423 | 176 | 29 |
| Food & Staples Retailing | 193 | 37 | 12 |
| Food, Beverage & Tobacco | 674 | 116 | 41 |
| Health Care Equipment & Services | 664 | 236 | 37 |
| Household & Personal Products | 148 | 36 | 7 |
| Insurance | 110 | 48 | 3 |
| Materials | 1609 | 256 | 75 |
| Media & Entertainment | 558 | 139 | 36 |
| Pharmaceuticals, Biotechnology & Life Sciences | 1216 | 328 | 47 |
| Real Estate | 269 | 113 | 2 |
| Retailing | 619 | 170 | 39 |
| Semiconductors & Semiconductor Equipment | 369 | 91 | 13 |
| Software & Services | 1073 | 271 | 38 |
| Technology Hardware & Equipment | 845 | 149 | 26 |
| Telecommunication Services | 138 | 56 | 19 |
| Transportation | 420 | 92 | 31 |
| Utilities | 299 | 103 | 22 |
| Total | 14433 | 3536 | 746 |

## Table A4: Robustness: Excluding Energy, Financials, and Utilities Sectors

This table summarizes the results of cross-sectional regressions of cumulative stock returns on the climate risk exposure measure after excluding certain sectors. Panel A presents the results without the energy sector. Panel B presents the results without financials and utilitites sectors. The dependent variables are the total returns for the three periods (Build-up, Outbreak, and Continuation). The explanatory variables include firms' transition and physical risk, inflation exposure, international exposure, and various firm characteristics, but only the coefficients for ESG, transition risk, and physical risk are displayed. Country and industry fixed effects are included as control variables. All continuous variables are winsorized at the 1 percent and 99 percent levels and standardized to have zero mean and unit variance. All variables are defined in Table A1. The t-statistics (based on robust standard errors) are reported in parentheses below the coefficient estimates. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ret^{Buildup}$ | | | $Ret^{Outbreak}$ | | | $Ret^{Continuation}$ | |
| Sample | ECC | ECC+10K | 10K | ECC | ECC+10K | 10K | ECC | ECC+10K | 10K |
| Climate Risk Measure | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ | $Var^{ECC}$ | $Var^{ECC}$ | $Var^{10K}$ |
| Panel A: Excluding Energy Sector | | | | | | | | | |
| $Trans$ | 0.564*** | 1.165*** | 0.518 | 0.633** | 2.243*** | 3.604*** | 0.416* | 0.415 | 0.298 |
| | (2.67) | (2.63) | (0.99) | (2.39) | (4.42) | (6.49) | (1.78) | (0.92) | (0.78) |
| $Phy$ | -0.0851 | -0.582** | 0.248 | 0.0086 | -0.0956 | 0.219 | 0.215 | 0.189 | 0.686** |
| | (-0.57) | (-2.28) | (0.82) | (0.06) | (-0.36) | (0.72) | (1.40) | (0.77) | (2.24) |
| $ESG^{Refinitiv}$ | 0.431* | 0.102 | 0.0965 | -0.0668 | -0.0005 | 0.0804 | -0.478* | -0.197 | -0.282 |
| | (1.71) | (0.28) | (0.26) | (-0.29) | (-0.00) | (0.26) | (-1.89) | (-0.56) | (-0.80) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 3360 | 1625 | 1643 | 3360 | 1625 | 1643 | 3353 | 1622 | 1640 |
| Panel B: Excluding Financials and Utilities Sector | | | | | | | | | |
| $Trans$ | 0.470** | 0.833 | 1.128** | 0.463* | 1.706*** | 2.978*** | 0.374 | 0.602 | 0.714* |
| | (2.08) | (1.63) | (2.08) | (1.75) | (3.23) | (5.48) | (1.59) | (1.19) | (1.67) |
| $Phy$ | -0.0340 | -0.559* | 0.0024 | -0.0738 | -0.112 | 0.468 | 0.270* | 0.164 | 0.502 |
| | (-0.20) | (-1.70) | (0.01) | (-0.47) | (-0.37) | (1.41) | (1.66) | (0.60) | (1.47) |
| $ESG^{Refinitiv}$ | 0.375 | -0.0008 | 0.0419 | -0.0436 | -0.0246 | 0.180 | -0.522* | -0.183 | -0.223 |
| | (1.40) | (-0.00) | (0.10) | (-0.18) | (-0.07) | (0.52) | (-1.93) | (-0.46) | (-0.57) |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 3114 | 1443 | 1458 | 3114 | 1443 | 1458 | 3108 | 1442 | 1457 |

## Table A5: International Sales

This table summarizes the results of cross-sectional regressions of cumulative stock returns with the information of international sales as additional controls. The dependent variables are the total returns in the three periods (Build-up, Outbreak, and Continuation). The explanatory variables include proxies for firms' transition and physical risk, inflation exposure, international exposure, and various firm characteristics. Country and industry fixed effects are included as control variables. All continuous explanatory variables are winsorized at the 1 percent and 99 percent levels and standardized to have zero mean and unit variance. All variables are defined in Table A1. The t-statistics (based on robust standard errors) are reported in parentheses below the coefficient estimates. *,**, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ret^{Buildup}$ | | | $Ret^{Outbreak}$ | | | $Ret^{Continuation}$ | |
| $Trans^{ECC}$ | 0.435** | 0.778* | | 0.407* | 1.607*** | | 0.443** | 0.422 | |
| | (2.24) | (1.92) | | (1.73) | (3.69) | | (2.15) | (1.05) | |
| $Phy^{ECC}$ | -0.0603 | -0.502* | | 0.00760 | -0.0276 | | 0.190 | 0.0912 | |
| | (-0.39) | (-1.79) | | (0.05) | (-0.11) | | (1.26) | (0.37) | |
| $Trans^{10K}$ | | | 0.791 | | | 2.963*** | | | 0.702* |
| | | | (1.57) | | | (5.91) | | | (1.76) |
| $Phy^{10K}$ | | | 0.162 | | | 0.389 | | | 0.422 |
| | | | (0.50) | | | (1.32) | | | (1.38) |
| $ESG^{Refinitiv}$ | 0.459* | 0.205 | 0.199 | 0.0389 | 0.0607 | 0.193 | -0.475* | -0.246 | -0.308 |
| | (1.85) | (0.55) | (0.54) | (0.17) | (0.19) | (0.63) | (-1.91) | (-0.70) | (-0.87) |
| $\%INF$ | -0.251 | -0.333 | -0.442* | -0.928*** | -1.050*** | -1.198*** | -0.335* | -0.188 | -0.241 |
| | (-1.33) | (-1.25) | (-1.67) | (-5.44) | (-4.53) | (-4.94) | (-1.75) | (-0.74) | (-0.97) |
| $\%War$ | -0.0908 | 0.541 | 0.530 | -0.833*** | -0.619 | -0.641 | 0.428* | 0.914 | 0.882 |
| | (-0.52) | (1.55) | (1.52) | (-3.91) | (-1.52) | (-1.64) | (1.82) | (1.64) | (1.58) |
| $\#Russia$ | | -0.419 | -0.401 | | 0.0550 | 0.0520 | | 0.184 | 0.285 |
| | | (-1.00) | (-0.96) | | (0.16) | (0.15) | | (0.45) | (0.68) |
| $\#Ukraine$ | | 0.162 | 0.166 | | -0.0140 | 0.0118 | | 0.400 | 0.336 |
| | | (0.41) | (0.42) | | (-0.04) | (0.04) | | (0.99) | (0.82) |
| $\#China$ | | 0.120 | 0.118 | | -0.842*** | -0.879*** | | -0.390 | -0.468 |
| | | (0.33) | (0.33) | | (-2.80) | (-3.19) | | (-1.13) | (-1.35) |
| $\mathbb{1}_{Action}$ | -0.109 | 0.276 | 0.392 | -2.719*** | -1.747** | -1.520* | -0.630 | -0.839 | -0.792 |
| | (-0.15) | (0.24) | (0.34) | (-4.30) | (-2.03) | (-1.79) | (-0.90) | (-0.86) | (-0.81) |
| $\mathbb{1}_{Active}$ | 2.489 | 4.168 | 3.967 | -2.284 | -1.410 | -2.000 | 1.116 | 0.524 | 0.167 |
| | (1.23) | (1.25) | (1.17) | (-0.94) | (-0.59) | (-0.76) | (0.52) | (0.15) | (0.05) |
| $IntSale$ | 0.0807 | -0.0054 | 0.0807 | -0.957*** | -1.106*** | -0.962*** | -0.227 | -0.424 | -0.425 |
| | (0.36) | (-0.02) | (0.23) | (-4.41) | (-3.36) | (-3.00) | (-0.98) | (-1.15) | (-1.16) |
| $\mathbb{1}_{IntSaleNA}$ | 1.072* | 1.361 | 1.484* | -0.446 | -0.423 | -0.363 | -0.219 | 0.0805 | 0.149 |
| | (1.82) | (1.55) | (1.69) | (-0.83) | (-0.56) | (-0.49) | (-0.37) | (0.09) | (0.17) |
| $\beta^{MKT}$ | 0.371 | 0.408 | 0.459 | -0.821*** | -1.273*** | -1.102*** | -0.0285 | -1.258** | -1.186** |
| | (1.20) | (0.80) | (0.91) | (-3.03) | (-3.00) | (-2.61) | (-0.09) | (-2.47) | (-2.35) |
| $Size$ | -0.534 | -0.718 | -0.708 | -0.434 | -1.427*** | -1.631*** | 2.804*** | 3.638*** | 3.709*** |
| | (-1.54) | (-1.30) | (-1.30) | (-1.41) | (-3.07) | (-3.57) | (8.15) | (6.70) | (6.89) |
| $BTM$ | 0.709** | 0.143 | 0.168 | 0.0688 | -0.463 | -0.519 | -0.564* | -0.691 | -0.668 |
| | (2.36) | (0.31) | (0.37) | (0.26) | (-1.13) | (-1.29) | (-1.90) | (-1.59) | (-1.55) |
| $ROA$ | 2.530*** | 2.063** | 2.134** | 0.0211 | 0.506 | 0.589 | -0.0207 | -0.146 | -0.00177 |
| | (5.65) | (2.13) | (2.24) | (0.06) | (0.74) | (0.84) | (-0.04) | (-0.14) | (-0.00) |
| $Cash$ | -0.648** | -0.246 | -0.216 | -0.327 | -0.544 | -0.402 | 0.996*** | 1.790*** | 1.960*** |
| | (-2.01) | (-0.49) | (-0.43) | (-1.15) | (-1.48) | (-1.10) | (2.98) | (3.48) | (3.81) |
| $Leverage$ | 0.348* | 0.198 | 0.166 | -0.383** | -0.455** | -0.523** | 0.145 | -0.240 | -0.273 |
| | (1.73) | (0.71) | (0.60) | (-2.45) | (-2.18) | (-2.46) | (0.69) | (-0.95) | (-1.10) |
| $Ret^{Buildup}$ | | | | 0.0690 | -0.259 | -0.249 | | | |
| | | | | (0.32) | (-0.88) | (-0.88) | | | |
| $Ret^{Outbreak}$ | | | | | | | -0.916*** | -0.321 | -0.350 |
| | | | | | | | (-3.92) | (-0.85) | (-0.89) |
| Constant | 7.694 | -11.31*** | -11.28*** | -5.929 | -0.988 | -1.098 | 13.21*** | 19.02*** | 19.31*** |
| | (0.74) | (-3.23) | (-3.20) | (-1.63) | (-0.30) | (-0.34) | (2.64) | (6.57) | (6.63) |
| Country FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Industry FE | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Std Error | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust | Robust |
| Observations | 3536 | 1690 | 1709 | 3536 | 1690 | 1709 | 3528 | 1687 | 1706 |
| R-squared | 0.144 | 0.117 | 0.120 | 0.322 | 0.296 | 0.314 | 0.177 | 0.215 | 0.218 |