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The impact of the Russia-Ukraine conflict on energy firms: A capital market perspective

Martin Nerlinger [a,*], Sebastian Utz [b,c]

[a] School of Finance and Swiss Finance Institute, University of St. Gallen, Unterer Graben 21, St. Gallen 9000, Switzerland
[b] Faculty of Business and Economics, University of Augsburg, Universitaetsstrasse 12, Augsburg 86159, Germany
[c] Centre for Climate Resilience, University of Augsburg, Germany

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ABSTRACT

We investigate whether the Russia-Ukraine conflict has affected energy firms' stock prices. Based on a global sample of 1630 energy firms, we conduct an event study around Russia's invasion on February 24, 2022. We find that cumulative average abnormal returns of these firms are positive around the event, i.e., energy firms outperformed the stock market. This outperformance is higher for North American firms than European and Asian ones. Our results provide evidence of energy firm outperformance in those export markets that compete with Russian suppliers of renewables, fossil fuels and uranium, following the Russian-Ukraine invasion.

1. Introduction

The outbreak of the Russia-Ukraine military conflict has implications for supply chains and the availability of fossil fuels, which are particularly needed in power generation worldwide. In this paper, we investigate how this political event impacts firms' profitability in the energy sector by analyzing stock returns. The business model of energy firms focuses, amongst others, on extracting and selling commodities and components that are used during the process of electric power generation.[1] We aim to understand the impact of the Russia-Ukraine military conflict on these firms by conducting an event study in which the start of the military operation on February 24, 2022, acts as the event date. In general, we find clear evidence that energy firms significantly outperformed the stock market around the event. This finding holds for all types of energy segments, i.e., renewables, fossil fuels, and uranium. However, we find differences in the outperformance according to firm location. The North American energy firms show significantly higher outperformance than European and Asian firms.

We consider the invasion of Russian troops into Ukraine as an event in our empirical analysis (similar to Basnet et al., 2022;

* Corresponding author.
E-mail address: martin.nerlinger@unisg.ch (M. Nerlinger).

[1] Besides extracting and selling commodities and components that are used during the process of electric power generation, energy firms offer a variety of other services and products related. As one example for an industry subgroup, the Coal Industry Group includes the following activities: Coal Mining Support, Coal Wholesale, and Coal NEC (not elsewhere classified): The Coal Mining Support activity consists of companies engaged in support activities related to coal, such as testing, tunneling, blasting, training, and other contract-based, coal-related services. The Coal Wholesale activity consists of companies engaged in wholesaling coal. The Coal NEC activity consists of companies engaged in the mining and beneficiating of coal and providing support service for coal. Other industry subgroups such as oil & gas and renewables show similar, but technology-specific activities.

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Boubaker et al., 2022; Boungou and Yatié, 2022; Deng et al., 2022; Huang and Lu, 2022; Mohamad, 2022; Tosun and Eshraghi, 2022). This event allows us to study how an unanticipated change in the market environment affects stock prices of firms in the energy sector. One example of an unanticipated change in the market environment was a substantial change in commodity prices (see Fig. 1). While the price of natural gas and oil increased to a certain extent, the price of coal experienced an increase of almost 150% immediately after February 24, 2022. Moreover, political and economic sanctions against Russia were answered with the Russian announcement of a possible shortage or even a stop of gas supply. Therefore, the start of the Russia-Ukraine military conflict could indicate a reassessment of national energy plans (Tollefson, 2022). If capital market participants anticipated significant adjustments in energy production plans, stock markets would react accordingly. For instance, Ferstl et al. (2012) document a significant decline in the stock prices of German nuclear power generating firms after the German government decided to terminate nuclear power generation in the aftermath of the Fukushima-Daiichi accident in 2011.

Our study contributes to the literature on exogenous shocks (including, for instance, wars and natural disasters) and their impact on capital markets. We present evidence that in a short period after Russia's invasion of Ukraine on February 24, 2022, firms from the energy sector have, on a global average, experienced positive cumulative average abnormal returns (CAARs). The tests for different regions (Asia, Europe, North America) reveal that these positive CAARs in a short event window of three days around the event mainly stem from the North American sample, while European firms show negative CAARs. Firms from the renewable energy industry subgroup experienced a short-lived upward movement a few days after the invasion and subsequently underperformed fossil and nuclear energy. In particular, firms from the uranium energy industry subgroup show high CAARs. These findings might also add to the discussion of Hook and Hume (2022) in the Financial Times on whether the Ukraine war will derail the green energy transition. Since fossil fuels and uranium-based energy technology firms observe an outperformance on the stock market, investors appear to still believe in these business models. These results are robust to a set of additional tests such as the estimation of abnormal returns with different numbers of risk factors, a different risk factor matching approach, the focus on large stocks, the focus on firms located in the top oil and gas exporting countries, and to changes in the length of the estimation period.

2. Data and methodology

For our analyses, we use a global stock sample that includes all firms in the economic sector "Energy (50)" according to the Refinitiv Business Classification. Our sample consists of 1630 firms from 75 countries with sufficient return observations around the event and the estimation window. All data points are from Refinitiv Datastream and Worldscope. We use the industry subgroup classification (TRBC) to divide our sample into five groups according to their main course of energy generation: Coal (501,010), Oil and Gas (501,020), Oil and Gas Related Equipment and Services (501,020), Renewable Energy (502,010), and Uranium (503,010). The distribution across industry groups and countries is shown in Table 1. Although the firms of the oil and gas subgroup include almost half of the sample firms, all industry subgroups contain a reasonable number of firms to be included in our empirical analysis.

We apply a standard event study[2] with the following parameters: The main event is defined as February 24, 2022, i.e., the start of the Russia-Ukraine conflict. Our estimation period of 250 daily returns ends 20 trading days before the event day. Our event window ranges from –20 to +20 days around the event day (Day 0). For each firm, we estimate daily abnormal stock returns during the event period using the Fama and French (1993) Three-Factor model based on global factors obtained from the website of Kenneth R. French.[3] We follow the common event study approach and define average abnormal returns (AAR) of a specific day of a portfolio of stocks as the average of the abnormal stock returns on this day. The cumulative average abnormal return (CAAR) is the sum of the AAR over a certain period of time. We show the statistical significance of the results using t-test. Unported results show that our findings are robust to test statistics such as the Patell test (Patell, 1976), the Adjusted Patell test (Kolari and Pynnönen, 2010), and the Wilcoxon signed-ranks test (Wilcoxon, 1945).

The event study setting is appropriate to elicit whether the outcome variable (i.e., CAAR) of the sample firms reacts to the event (i.e., the invasion) in a short time period. The effect can be attributed to the event since we consider the same firms in two settings (before and after the event). Since the CAAR periods are short (3 days, 7 days, 12 days, 22 days), it is likely that Russia's invasion is the only substantial change to the sample firms. Changes in firm characteristics that might impact CAAR are unlikely to be observed in these short periods.

Moreover, we consider a firm's current stock price as the value investors attribute to the future profitability of a firm. Thus, a positive CAAR indicates that the firm's stock price increased more than the stock price of a comparable firm. According to the price-building mechanisms in capital markets, a higher stock price indicates that more investors show demand for the firm (possibly due to the belief that the firm's profitability has increased).

3. Empirical results and discussion

3.1. Main results

The main results of our analysis show that energy firms experienced positive CAARs around the invasion of the Russian troops in the

[2] Our empirical tests are conducted with the STATA "eventstudy2" command.

[3] We thank Kenneth R. French for providing the return data on his website: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

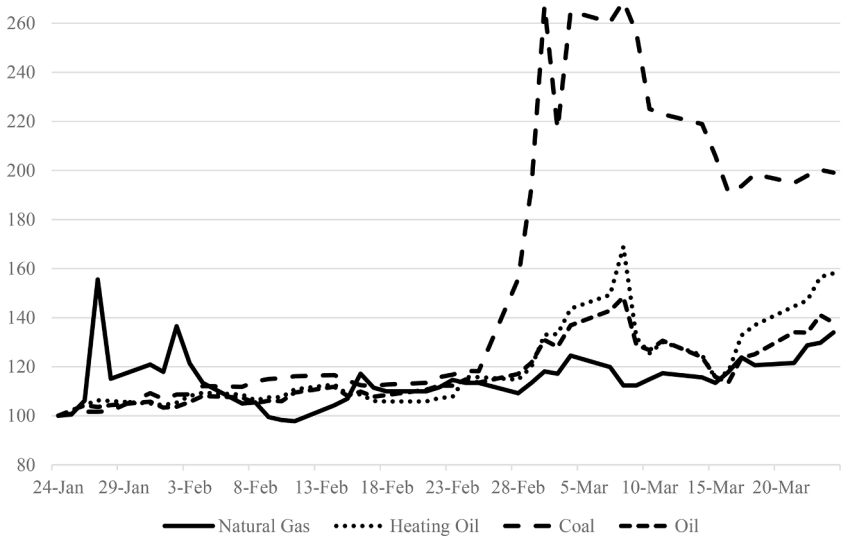

Fig. 1. Energy prices around the event. This figure shows energy commodity indices for Natural Gas, Heating Oil, Coal, and Oil over the period from January 24, 2022, to March 24, 2022 around the event date.

Table 1
Industry group and continent breakdown

	Industry Group	
	N	*%*
Coal	143	8.77
Oil & Gas	759	46.56
Oil & Gas Equipment and Services	410	25.15
Renewable Energy	252	15.46
Uranium	66	4.05
Total	*1,630*	
	Continent	
	N	*%*
Africa	17	1.04
Asia	586	35.95
Australasia	108	6.63
Europe	293	17.98
North America	596	36.56
South America	30	1.84
Total	*1,630*	

This table shows an industry group and continent breakdown of the global stock sample. The number and percentage within both categories are shown.

Ukraine. Table 2 contains CAARs of all energy firms in the sample as well as of the five industry subgroups of the energy sector for the periods of [–1;1], [–5;5], [–1;2], [–1;5], [–1;10] and [–1;20] around the event date. Except for two CAARs (the CAAR of the coal group in the [–1;1] and [–1;2] period), all CAARs are significantly higher than zero. Therefore, the stocks of the energy sector firms outperformed the market during the period around the considered event in general.

Furthermore, we ask the question of whether the Russia-Ukraine conflict impacted the stock prices of energy firms with different energy production technologies differently. While the short-term reaction on the capital market for renewable energy firms was positive with a CAAR of 0.019 (0.038) on a [–1;1] ([–1;2]) event window, market participants appeared to favor uranium stocks with a CAAR of 0.049 (0.100) to a higher extent. Moreover, in the event windows spanning over 5, 10, and 20 trading days after the event, the renewable energy firms generated lower CAARs compared with the firms of the industry subgroups coal, oil and gas, oil and gas equipment and services, and uranium. The uranium firms outperformed the market by the largest CAARs compared to the other technologies.[4]

Table 2 also reports the number of firms in a specific industry group-event window tuple. The different numbers of sample firms mainly stem from stock exchange holidays around the event. For example, on February 21, 2022, the American stock exchange

[4] Unreported results show that uranium firms generated a statistically significant outperformance compared to other industry subgroups in all event windows.

Table 2
Cumulative average abnormal returns across different energy industry groups

	CAAR [–1;1]				CAAR [–5;5]			
Industry Group	*FF3*	*CAPM*	*Carhart*	*N*	*FF3*	*CAPM*	*Carhart*	*N*
All firms	0.011***	0.005*	0.012***	1,618	0.058***	0.058***	0.055***	1,562
Coal	–0.017**	–0.023***	–0.016***	143	0.078***	0.079***	0.075***	120
Oil & Gas	0.009**	0.000	0.010***	756	0.057***	0.053***	0.054***	729
Oil & Gas Equip. & Serv.	0.015***	0.005	0.015***	403	0.058***	0.052***	0.056***	401
Renewable Energy	0.019***	0.022***	0.021***	249	0.027**	0.046***	0.020*	248
Uranium	0.049***	0.042***	0.049***	67	0.152***	0.164***	0.152***	64
	CAAR [–1;2]				CAAR [–1;5]			
Industry Group	*FF3*	*CAPM*	*Carhart*	*N*	*FF3*	*CAPM*	*Carhart*	*N*
All firms	0.029***	0.026***	0.031***	1,546	0.051***	0.048***	0.053***	1,592
Coal	–0.005	–0.007	–0.003	123	0.074***	0.073***	0.076***	126
Oil & Gas	0.025***	0.018***	0.027***	726	0.044***	0.037***	0.046***	747
Oil & Gas Equip. & Serv.	0.029***	0.019***	0.030***	392	0.052***	0.041***	0.053***	401
Renewable Energy	0.038***	0.055***	0.043***	240	0.028***	0.047***	0.032***	252
Uranium	0.100***	0.106***	0.101***	65	0.159***	0.166***	0.159***	66
	CAAR [–1;10]				CAAR [–1;20]			
Industry Group	*FF3*	*CAPM*	*Carhart*	*N*	*FF3*	*CAPM*	*Carhart*	*N*
All firms	0.059***	0.012***	0.061***	1,630	0.071***	0.070***	0.073***	1,620
Coal	0.045***	–0.016***	0.048***	143	0.074***	0.075***	0.077***	143
Oil & Gas	0.049***	0.010***	0.051***	759	0.062***	0.055***	0.065***	753
Oil & Gas Equip. & Serv.	0.060***	0.015***	0.062***	410	0.070***	0.057***	0.072***	406
Renewable Energy	0.054***	0.021***	0.060***	252	0.063***	0.097***	0.069***	252
Uranium	0.209***	0.049***	0.210***	66	0.194***	0.210***	0.195***	66

This table shows the cumulative average abnormal returns (CAAR) across different energy industry groups and event windows around the event date. We estimate daily abnormal returns using the Fama and French Three–Factor model, the CAPM, and the Carhart Four-Factor Model. The event windows ranging from the shortest window of days [–1;1] to the longest [–1;20] are calculated for all firms within the sample and for the industry subgroups: Coal, Oil & Gas, Oil & Gas Equipment & Services, Renewable Energy, and Uranium. The significance of the CAAR is determined via t–test. ***, **, and * indicate significance at the 0.1%, 1%, and 5% level, respectively.

(Presidents' Day) and the Canadian stock exchange (Family Day) were closed. Additionally, on February 23, 2022, the Japanese stock exchange (Emperor's Birthday) was closed, and on February 28, 2022, and on March 1, 2022, some South American exchanges were closed due to Carnival. Since we only include firms with a sufficiently large number of observations in the event and the estimation window in the analysis, we have to drop some firms for some event windows.

3.2. Return differences between different regions

In the next step, we analyze the regional differences in the pattern of CAARs of the energy stocks. We apply this test since the scale of dependency between Russia and different regions regarding the supply of oil, gas, and coal differs. Being the world's top 3 oil producer and the 2nd largest producer of natural gas (see IEA 2022), Russia has a high importance for the oil, gas, and coal supply for European (see Singh, 2022) and Asian (see Reuters, 2022) countries. While oil and gas are one of the main sources in European countries, the energy production in Asian countries relies to a large extent on coal. North America is rather independent of Russian commodities. These different dependencies of different regions to specific commodities (and the scale of their supply by Russia) raises the question of whether the firms of different regions show different CAAR patterns accordingly.

Therefore, we consider the CAARs in the intervals of [–1;1] and [–1;10] and divide the "All firms" and the five industry subgroups into the regions of Asia, Europe, and North America (NA), following the country classification of the developed market factors of Fama and French. These three regions comprise a total of 90 percent of stocks within our sample; therefore, we drop the other regions due to their small sample size.

Table 3 contains the CAARs of each region/group as well as the result of a two-sample t-test. For instance, in the [–1;1] period, the "All firms" group in Europe (CAAR = –0.020) performed significantly worse than the North American "All firms" group (CAAR = 0.039). The difference (–0.059) is statistically smaller than zero at a 0.1% level. Table 3 reveals that in no case the performance of the North American sample is significantly lower than for the Asian or European peers. Therefore, the stock prices of the North American energy sector did not observe a substantial correction after the start of the Russia-Ukraine conflict. While the European stocks showed a negative reaction in the three trading days around the event, in the long run, the CAARs of the European energy firms were also positive.

The CAAR [–1;1] of the renewable energy sample in Europe (–0.004) documents the "highest" performance among the European industry subgroups in the short run. However, the CAAR of the renewable energy sample in Europe (0.046) is only number three compared to the other industry subgroups in the [–1;10] window. In particular, uranium shows high positive CAARs (0.185) in the two

Table 3
Regional differences in cumulative average abnormal returns

Panel A. Europe vs. North America						
	CAAR [–1;1]			CAAR [–1;10]		
Industry Group	*Europe*	*NA*	*Difference*	*Europe*	*NA*	*Difference*
All firms	–0.020	0.039	–0.059***	0.036	0.128	–0.092***
Coal	–0.112	0.029	–0.141**	–0.060	0.166	–0.225*
Oil & Gas	–0.022	0.037	–0.059***	0.023	0.119	–0.096***
Oil & Gas Equip. & Serv.	–0.011	0.030	–0.041***	0.056	0.110	–0.054
Renewable Energy	–0.004	0.075	–0.079***	0.046	0.170	–0.125*
Uranium	–0.039	0.054	–0.093	0.185	0.205	–0.020
Panel B. Europe vs. Asia						
	CAAR [–1;1]			CAAR [–1;10]		
Industry Group	*Europe*	*Asia*	*Difference*	*Europe*	*Asia*	*Difference*
All firms	–0.020	–0.003	–0.017**	0.036	–0.006	0.042***
Coal	–0.112	–0.016	–0.097***	–0.060	0.037	–0.097
Oil & Gas	–0.022	–0.005	–0.017	0.023	–0.016	0.040*
Oil & Gas Equip. & Serv.	–0.011	0.006	–0.017	0.056	–0.022	0.078***
Renewable Energy	–0.004	0.005	–0.009	0.046	–0.001	0.047*
Uranium	–0.039	0.009	–0.047	0.185	–0.152	0.337
Panel C. North America vs. Asia						
	CAAR [–1;1]			CAAR [–1;10]		
Industry Group	*NA*	*Asia*	*Difference*	*NA*	*Asia*	*Difference*
All firms	0.039	–0.003	0.042***	0.128	–0.006	0.134***
Coal	0.029	–0.016	0.044*	0.166	0.037	0.128**
Oil & Gas	0.037	–0.005	0.042***	0.119	–0.016	0.135***
Oil & Gas Equip. & Serv.	0.030	0.006	0.023*	0.110	–0.022	0.132***
Renewable Energy	0.075	0.005	0.070***	0.170	–0.001	0.171***
Uranium	0.054	0.009	0.045	0.205	–0.152	0.357

This table shows differences in the cumulative average abnormal returns (CAAR) across different regions, energy industry groups, and event windows around the event date. We estimate daily abnormal returns using the Fama and French Three-Factor model. The event windows ranging from the shortest window of days [–1;1] to the longest [–1;10] are calculated for all firms in the sample and for the industry subgroups: Coal, Oil & Gas, Oil & Gas Equipment & Services, Renewable Energy, and Uranium in the regions Europe, North America, and Asia. The significance of the difference in CAAR is determined via t-test. ***, **, and * indicate significance at the 0.1%, 1%, and 5% level, respectively.

weeks after the event. In North America (Asia), uranium (coal) energy firms observed the highest CAARs [–1;10] in the industry subgroups comparison. In all three samples, the renewable energy firm sample was among the top3 industry subgroups that observed the highest CAARs [–1;10].[5]

In summary, the results show evidence supporting the conjecture that the dependency pattern to Russian commodity supply impacts the CAARs. North America with a low exposure to Russian commodities shows the highest CAARs (that are even significantly higher than the ones in Europe and Asia) in the event window. A possible explanation for the slightly higher CAARs of Asian coal energy firms compared to the European ones (significant in the short-term) is the high proportion of coal-based energy production in Asia (see IndexMundi 2022). The expected shortage of Russian coal supply causes an increase in the coal price, and thus local Asian coal energy firms might increase profits due to higher selling prices. The same explanation applies for the significantly higher CAARs of the European sample for oil and gas energy firms (compared to Asia). Nevertheless, future research might detail this and possible other explanations for the presented CAAR pattern.

3.3. Robustness

We ran different specifications of our tests to gage the robustness of the results. The robustness tests (summarized in Table 4) elicit that our main results are not driven by a specific empirical setting. In detail, we estimated abnormal returns also based on the Fama French Five-Factor model (see Table 4, Panel A.1). We also substituted the returns of the global risk factors by the returns of the risk factors of the respective developed market (Asia-Pacific, Europe, North America, USA, Japan, and Developed for all other countries; see Table 4, Panel A.2). In a second step, we moved the event window before the event date (Pre-Event, Panel B.1) and one year into the past (Placebo Event, Panel B.2). Since we do not find similar, highly significant CAARs in these periods, it is likely that the observed CAARs in the "real" event window are due to Russia's invasion of Ukraine. Additionally, we used an estimation window with twice (half) the number of trading days and presented the results in Panel B.3 (B.4) of Table 4. Finally, we analyzed CAARs of different subsamples: the subsample of the large (i.e., the above median-sized) firms (Panel C.1) and the subsample of firms that are located in the top10 oil and gas exporting countries[6] (Panel C.2). Neither of these model specifications generated results that contrast to the main results of this study.

[5] Unreported results of tests on the comparison between the CAARs of different regions are also robust to estimating the abnormal returns with respect to the CAPM and the Carhart Four-Factor models.

[6] The lists of the largest oil and gas exporting countries were provided by Statista (2022). The resulting subsample consists of 834 firms.

Table 4
Robustness tests

Factor Variation	*Panel A.1 Fama French Five–Factor*		*Panel A.2 Factor Matching*	
	CAAR [–1;1]	CAAR [–1;10]	CAAR [–1;1]	CAAR [–1;10]
All firms	0.010***	0.058***	0.015***	0.068***
Coal	–0.017**	0.044***	–0.005	0.065***
Oil & Gas	0.008**	0.048***	0.012***	0.057***
Oil & Gas Equip. & Serv.	0.014***	0.060***	0.017***	0.067***
Renewable Energy	0.017***	0.052***	0.024***	0.069***
Uranium	0.047***	0.209***	0.043***	0.216***
Window Variation	*Panel B.1 Pre–Event Period*		*Panel B.2 Placebo Test*	
	CAAR [–20; –2]	CAAR [–10; –2]	CAAR [–366; –364]	CAAR [–366; –355]
All firms	0.014**	0.007*	–0.035	–0.015*
Coal	0.073***	0.010	–0.005	–0.036**
Oil & Gas	0.020**	0.012**	0.004	–0.020**
Oil & Gas Equip. & Serv.	0.010	0.015**	0.009	–0.019*
Renewable Energy	–0.011	–0.014	–0.019*	–0.121***
Uranium	–0.051	–0.037	–0.003	–0.073*
	Panel B.3 Double Est. Window		*Panel B.4 Half Est. Window*	
	CAAR [–1;1]	CAAR [–1;10]	CAAR [–1;1]	CAAR [–1;10]
All firms	0.010***	0.055***	0.010***	0.052***
Coal	–0.019**	0.048***	–0.015*	0.049***
Oil & Gas	0.007*	0.044***	0.007**	0.042***
Oil & Gas Equip. & Serv.	0.014***	0.060***	0.013***	0.053***
Renewable Energy	0.017**	0.044***	0.019***	0.053***
Uranium	0.046***	0.198***	0.039**	0.167***
Firm Variation	*Panel C.1 Large Firms*		*Panel C.2 Oil & Gas Exporters*	
	CAAR [–1;1]	CAAR [–1;10]	CAAR [–1;1]	CAAR [–1;10]
All firms	0.014***	0.064***	0.031***	0.110***
Coal	–0.027***	0.055***	–0.003	0.071
Oil & Gas	0.009***	0.047***	0.030***	0.100***
Oil & Gas Equip. & Serv.	0.017***	0.071***	0.022***	0.099***
Renewable Energy	0.037***	0.075***	0.063***	0.160***
Uranium	0.086***	0.290***	0.046**	0.188***

This table shows the cumulative average abnormal returns (CAAR) across different energy industry groups and event windows around the event date. The event windows ranging from the shortest window of days [–1;1] to the longest [–1;10] are calculated for all firms in the sample and for the industry subgroups: Coal, Oil & Gas, Oil & Gas Equipment & Services., Renewable Energy, and Uranium. In Panel A.1, we replaced the Fama and French Three-Factor model with the Fama and French Five-Factor model. In Panel A.2, we match factor returns based on the region of the stocks to the regional factors instead of using the global Fama and French factors. In Panel B.1 (B.2), we use an estimation window with twice (half) the number of days. In Panel C.1, we repeat our main analysis using only large (above-median) firms within our sample, and in Panel C.2, we use only firms that are located in large oil & gas exporting countries. The significance of the CAAR is determined via t-test. ***, **, and * indicate significance at the 0.1%, 1%, and 5% level, respectively.

4. Conclusion

This study has investigated whether the Russian invasion of Ukraine, starting on February 24, 2022, has generated an abnormal stock price reaction in energy firms. Our results show that energy firms experienced positive cumulative average abnormal returns around the event date. The industry subgroup results indicate that stock market participants expect conventional energy segments such as uranium technology to be profitable in the future. Concerning the required and envisioned green energy transition with a focus on renewable energy sources (and thus the expectation that investors believe renewable energy firms benefit most from the considered event), the reasons for our results might be challenges such as long planning horizons for such an energy transition (Seetharaman et al., 2019). Nevertheless, the Glasgow Climate Change Conference (COP26) in late 2021 has highlighted the need for a fast transition to a net-zero economy to meet the goals of the Paris Agreement. An essential part of this transition is the energy transition from fossil fuels to renewables since electricity and heat production accounts for a quarter of global greenhouse gas emissions (EPA, 2022). The claim at COP26 was to "move away from coal and towards clean power about five times faster than at present" (COP26, 2022). In this context, our results indicate that capital markets respond very quickly to changes in supply chains triggered by unique events such as wars and that these events result in competitor markets responding to new market opportunities so as to take advantage of interruptions to supply chains. It might be an open question for future research to examine how long-term pressure on traditional supply chains supports the transition from carbon-intensive to more sustainable forms of energy.

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CRediT authorship contribution statement

Martin Nerlinger: Conceptualization, Methodology, Data curation, Software, Formal analysis, Writing – original draft, Writing – review & editing. **Sebastian Utz:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision.

Declaration of Competing Interest

None.

Data availability

The authors do not have permission to share data.

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