APAEA

Polemis, M., & Soursou, S. (2020). Assessing the Impact of the COVID-19 Pandemic on the Greek Energy Firms: An Event Study Analysis. *Energy RESEARCH LETTERS, 1*(3). https://doi.org/10.46557/001c.17238

COVID-19 and Energy

Assessing the Impact of the COVID-19 Pandemic on the Greek Energy Firms: An Event Study Analysis

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Keywords: event study analysis, financial performance, energy industry, covid-19

https://doi.org/10.46557/001c.17238

Energy RESEARCH LETTERS

Vol. 1, Issue 3, 2020

This study examines the impact of the COVID-19 pandemic on the stock returns of 11 Greek energy listed companies. Using an event study approach covering a window of 10 days before and 10 days after the general lockdown (23/3/2020), we show that the pandemic influenced returns of the majority of the listed energy firms. However, diverging from the event day sees the negative effects dissipating.

1. Introduction

The energy industry has been significantly impacted by COVID-19. Energy companies have had to deal with a dual crisis; declining energy demand and lower prices for their products (Fu & Shen, 2020). Although the long-term consequences of the pandemic are difficult to estimate, there appears some scientific attempts to assess the short-term effects.

We employ the event study methodology taking into consideration the event day when the Greek Prime Minister announced lockdown (March 23, 2020). Following the event study methodology, we apply a time window of 10 days before and 10 days after the lockdown announcement (-10 + 10). Nevertheless, to assess the announcement's real impact, we also apply one time window of 20 days prior and 20 days after the event and one of 50 days before and 50 days since the lockdown announcement.[1] Our findings support that the COVID-19 crisis has affected the Greek energy industry differently. However, the majority of energy firms has reacted rapidly, returning to the state of equilibrium. Nevertheless, all the companies have suffered from successive upward and downturn trends during the examined period,

2. Data and Methodology

This note studies Greek energy firms'abnormal returns based on the market model. Our data are obtained from the Athens Stock Exchange (ASE) and contain daily information about stocks' closing prices. Our sample contains daily data for the stock prices of the Greek energy listed firms and the market index for the period of December 2, 2019 to July 2, 2020. More precisely, we use 141 observations for each firm and the stock index, while the sample contains overall 1692 observations.

First, we define an event window of 10 days before the Greek Prime Minister's address (lockdown) and 10 days after the announcement of restrictions. Day 0 is defined as the announcement day of the implemented lockdown. We also include an event window of -/+20 days and -/+50 days surrounding the announcement day. These extended window based analysis forms part of our robustness test. We add to these estimates from the Mean Adjusted Return Model (MEARM) and the Market Adjusted Return Model (MARM). Due to space constrains these MEARM and MARM results are not reported but are available upon request.

Based on the rational expectations' theory and markets' efficiency hypothesis over the investors' behavior, we use the market model. For obtaining firm *j's* returns on day *t*, which is relative to a market return (Fotis et al., 2011), consider:

$$R_{jt} = \alpha + \beta\, R_{mt} + \varepsilon j_t \qquad (1)$$

The R_{jt} denotes the firm's return while R_{mt} is the market returns on day *t*. Our estimation period is defined from 02/1/2020 to 30/04/2020. Thus, the expected firm's return without the announcement would be:

$$\widehat{R_{jt}} = \hat{\alpha} + \widehat{\beta\, R_{mt}} + \varepsilon j_t \qquad (2)$$

Then, the abnormal return due to lockdown announcement can be obtained from:

$$AR_{\mathrm{jt}} = R_{jt} - \widehat{R}_{jt}\$ = \$R_{jt} - (\hat{\alpha} + \widehat{\beta \mathrm{R}_{mt}}) \qquad (3)$$

Then, to calculate the average abnormal returns for each day in the event window, the sum of the *AR* divided by the number of the listed firms are utilized, according to the following formula:

$$AAR_{jt} = \frac{\sum_j AR_{jt}}{N} \qquad (4)$$

Where *N* represents the number of listed firms, *AR* denotes the daily abnormal returns for each listed firm in the days surrounding the announcement of the event being studied. Daily *ARs* can be calculated using various benchmarks: (1) market model; (2) net-of-market return; (3) net-of-characteristic matched portfolio (or matched firm) return; or (4) an equilibrium asset pricing model, such as the CAPM. The *AAR* denotes the daily abnormal returns for each listed firm in the days surrounding the announcement of the event being studied and *AR*.

The Cumulative Abnormal Returns (*CAR*) are calculated as:

1 To preserve space the results are available on request.

$$CAR_{jt} = \sum_{t=-m}^{+n} AR_{jt} \quad (5)$$

Where m=n= the 10 days prior and post the event. From Equation (4) the Cumulative Average Abnormal Returns (*CAAR*) are obtained:

$$CAAR_{jt} = \sum_{t=-m}^{+n} AAR_{jt} \quad (6)$$

3. Results and Discussion

Our estimates suggest that both the magnitude of the pandemic and the announcement of lockdown have influenced energy firms differently. As it is portrayed in Table 1, the impact of the event depends on the estimation window. As the estimation window expands, the observed impact weakens. The results from the relevant table indicate that 50 days before the announcement most of the energy firms are unaffected, whereas the *AR* of ELINOIL has been positively affected at the 1% significance level.

On the contrary, the firm AVAX during the -42-day is affected the most with an *AR* of -24%. The other estimates appear insignificant. Similarly, , the effects of the announcement are insignificant as we move apart from the event day (0 day), while some energy firms seem to ameliorate their position during certain days. For, instance, the *AR* of MYTILINAIOS during the 28th and the 44th post-event days are positive and statistically significant. By contrast, we obtain a negative *AR* of -4% for ELINOIL 38 days after the event.

As we approach the estimation window of -20, +20 days, we observe that the effects of the lockdown becomes stronger. However, the negative impact that concerns some firms is statistical significant at the 10% significance level. Fifteen days before the event, both ELINOIL and REVOIL have an *AR* of -7%. What is worth mentioning is that ELAKTROR *AR* reaches a record of -28% during the 12th day before the decision of lockdown.

Regarding the post-event period, the energy firms show signs of recovery. During the 11thday, ELAKTOR's *AR* reach 17% while MYTILINAIOS has a positive *AR* of 6%. ELAKTOR continues to improve its *AR* 13 days after the event by obtaining 15% *AR*. AVAX also has a positive *AR* during the 15th and 16thpost-event day, reaching 14% and 12%, respectively. CENERGY also obtains a positive and statistically significant *AR* of 7% on the 15th day after the event.

Ten days before the Prime Minister's address the negative effect of the forthcoming lockdown is evident. Given that six out of the eleven companies have a negative *AR*. Specifically, CENERGY and ELPE have a negative *AR* of -13% and -6%, respectively. AVAX also has negative *AR* 9 days before the event, while 8 days before the announcement the *AR* has a positive impact reaching 8% at the 1% significance level. However, 8 days before the lockdown's announcement we observe that ADMIE, AVAX, and ELAKTOR achieve positive *ARs* at the 1% level of significance, while ELAKTOR's *AR* reaches to 13%. This positive trend continues at -7 days when MYTILINAIOS and REVOIL improve their position achieving 5% and a 16% *AR* respectively. Despite the promising signals the situation worsens during the 6th day before the announcement where three firms record significant losses at the 1% significance level. Moreover, during the 5th day before the announcement, we observe that the returns of the firms behave differently. For instance, CENERGY has a strong and statistically significant *AR* of 9%, likewise ELPE and MYTILINAIOS achieving an *AR* of 5% and 6% respectively. By contrast, REVOIL'S returns fall sharply (-12%) at the 1% level of significance. Four days before the event ADMIE and TERNA record high *ARs* at the 1% level of significance, while PPC and MYTILINAIOS follow the same path, but at the 5% significance level, contrary MOTOROIL reaches a negative *AR* of -9% at the 1% significance level. MOTOROIL continues to fall 3 days before the lockdown, whereas only CENERGY sustains a positive *AR* among the other energy firms. The estimates show that the negative path for MOTOROIL is changing 2 days before the event, whilst CENERGY and PPC remain unaffected, succeeding a high and significant *AR* of 17% and 13%, respectively. However, the PPC declines sharply 1 day before the event, while only ELPE ameliorates with an AR of 6% at the 1% level of significance.

During the event day (0 day) none of the energy firms present statistically significant results, which is also the case for the first day of the lockdown. Two days after the event, ELINOIL and MOTOROIL are affected significantly at the 1% and 5% level of significance, respectively. Moreover, during the 4th day of the lockdown two firms are affected; CENERGY and ADMIE with the decreasing stock returns of -9% at the 1% level of significance and of -3% at the 5% level, respectively. Furthermore, REVOIL's *AR* is influenced negatively 7 days after, whereas ELPE improves its returns during the 8th post-event day.

To sum up, our estimates suggest that the returns of the energy firms are influenced mostly 10 days prior and 10 days after the event. For that purpose, we analyze further the -10, +10 days window by applying also the MEARM and the MARM. Focusing on the MARM, we observe that the majority of the energy firms 10 days before the announcement are affected greatly at the 1% significance level. Among them, PPC has been hit the most (-22%). One day after, six out of eleven companies show signs of recovery, which is opposite to the Market Model's results. However, during the -8 day of the event window the firms' positions are again worsening. Likewise at the -7 day where eight of the eleven energy companies decline at the 1% significance level. Similarly, on the -5 day,the majority of the energy firms have highly negative *ARs* at the 1% level. However, 2 days and 1 day before the announcement, the market reacts differently and the firms improve significantly their position. As the investors expect the lockdown during the event day, they react according to the rational expectations theory and the *ARs* of the firms are negative and statistically significant, leading to a self-fulfilling prophecy.

Nevertheless, the following day the majority of the firms achieves a positive *AR*; CENERGY and AVAX have an *AR* of 9%, ADMIE, MOTOROIL, and MYTILINAIOS obtain an *AR* of 8%, PPC has an *AR* of 12%, while ELPE achieves an *AR* of 7%, ELLAKTOR one of 10% and TERNA one of 5%. Furthermore, 3 days after the event the firms' returns continue to decrease. During the 4th and the 5th post-event day, the results are insignificant, whilst on the 6th day, ELPE's *AR* continues to decline (-3% at the 5% level), likewise that of ADMIE and MYTILINAIOS. At the +9 day, almost all the firms –nine out of eleven- improve largely their returns at the 1% significance level.

Table 1: Abnormal returns of the sample companies

Period	CENERGY AR	ADMIE AR	AVAX AR	PPC AR	ELINOIL AR	ELLAKTOR AR	ELPE AR	MOTOROIL AR	MYTILINAIOS AR	REVOIL AR	TERNA AR
-10	-13%*	-2%	-8%***	-5%***	2%	-3%	-6%*	-2%***	-3%**	-4%	-6%
-9	1%	1%	-8%*	0%	0%	-3%	2%***	4%***	0%	-2%	0%
-8	4%	4%*	8%*	3%	1%	13%*	1%	4%	-1%	-5%***	2%
-7	6%***	-1%	1%	3%	1%	-1%	3%***	2%	5%*	16%*	-1%
-6	-6%	2%	-4%	-6%**	0%	2%	1%	-2%	-1%	-9%*	-6%*
-5	9%*	1%	6%	5%***	1%	4%	5%*	2%	6%*	-12%*	3%***
-4	1%	7%*	4%	6%**	0%	8%***	0%	-9%*	3%**	0%	8%*
-3	8%*	0%	5%***	5%***	-2%***	-7%***	-2%***	-14%*	-1%	0%	2%***
-2	17%*	-2%	-1%	13%*	-2%	-2%	-2%	6%**	3%***	6%***	-2%
-1	-3%	-4%	-1%	-11%*	2%***	-6%***	6%*	12%*	2%***	6%***	2%
0	-2%	0%	-4%	-2%	1%	-4%	0%	0%	1%	5%***	2%
1	-4%	0%	1%	2%	-1%	-2%	-1%	-2%	1%	-1%	0%
2	-5%	-1%	-1%	1%	-4%*	0%	-1%	-6%**	-1%	-5%	-3%***
3	-3%	1%	-1%	-3%	1%	-1%	0%	3%	-1%	3%	0%
4	-9%*	-3%**	0%	-2%	0%	-1%	-3%***	2%	-1%	0%	1%
5	1%	-1%	3%	2%	0%	0%	4%**	-2%	-2%***	-5%***	-2%
6	-1%	0%	0%	1%	1%	-1%	3%***	2%	-1%	2%	0%
7	0%	1%	1%	-2%	0%	-3%	-2%	1%	-1%	-9%*	1%
8	0%	0%	2%	2%	0%	-2%	5%*	2%	-2%***	4%	-1%
9	-3%	1%	0%	-4%***	0%	-3%	-1%	1%	2%	1%	-2%
10	0%	-1%	3%	-1%	1%	5%	0%	2%	0%	-3%	0%

Notes: This table presents the abnormal returns of the sample companies at different time windows. Denotes statistical significance at * p <0.01, ** p<0.05, *** p<0.1.

Regarding the *CAAR*, we calculate them in three different windows; one covering 101 days, i.e. (-50+50), one covering the 20 previous and 20 days after the event (-20 +20), i.e. 41 days and finally, one referring to the window of -10 + 10 days, i.e. 21 days. The *CAAR* for the (-50+50) period appears statistically insignificant. Similarly, the *CAAR* of the two other windows indicate that the results are insignificant. So, we cannot conclude to a safe inference about the impact of the announcement on the stocks.

4. Concluding remarks

This is the first study -to the best of our knowledge-to combine the event study methodology with the financial implications of the novel coronavirus pandemic in the energy sector. Applying the Market Model in the case of eleven Greek listed firms, we find that the pandemic crisis influences the level of stock returns. The event proxied by the lockdown has a significant effect on returns. Overall, our findings are in alignment with the market efficiency hypothesis suggesting that divergence from the long-run equilibrium settles down rapidly, while rational expectations theory explains the downward shifts during the pre-announcement period as well as on the event day in case of the negative abnormal returns.

Acknowledgments

We would like to thank the Editor-in-Chief, Professor Nickolas Apergis, for allowing us to revise and thus improve our paper, and an anonymous reviewer of the journal for fruitful and constructive comments. The views in this paper are the authors' alone. The usual disclaimer applies.

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