COVID-19 and Energy

COVID-19 and Corporate Performance in the Energy Industry

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COVID-19 has had a major impact on the global economy and the energy sector has also been significantly affected by the pandemic.. This paper studies the impact of COVID-19 on corporate performance in the energy industry and finds that COVID-19 has had a significant negative effect on the performance of energy companies. When goodwill impairment was introduced as a moderating variable, companies with goodwill impairment were more strongly affected by the pandemic. Therefore, decision makers at all levels should pay more attention to the impact of COVID-19 on energy companies and take countermeasures in order to mitigate the effects on the energy industry.

1.Introduction

The COVID-19 pandemic has affected many countries and regions around the world since January 2020 (Narayan & Phan, 2020). In China, the quarantine measures led to widespread factory closures across the country, resulting in a 6.8% decline in China's gross domestic product in the first quarter of 2020 compared to last year. Listed companies have suffered severely from this outbreak, which is mainly reflected in the decline in stock prices, revenue and profits. From the industry perspective, all sectors have been affected by the pandemic, especially the tourism and catering industries. These companies are characterized by social contact, and the implementation of the quarantine measures has resulted in job and incomes losses. However, the energy sector, as an important pillar of the national economy, has also been significantly affected by the pandemic. The energy industry has a large number of fixed assets, which leads to high fixed costs in daily operations. The high operating leverage brings about great risks. On the other hand, the energy industry is closely related to daily life, providing electricity, thermal energy and other necessities of life. Therefore, the stable development of the energy industry is imperative for social and economic stability of a country. With the onset of COVID-19 been recent, there is little research on the economic impact of COVID-19. In fact, little is known about how COVID-19 has affected the energy industry. Therefore, it is necessary to study the impact of COVID-19 on the energy industry and our focus is on the corporate performance of this industry.

This paper studies the impact of COVID-19 on the corporate performance in the energy industry by the panel data and Difference-in-Difference(DID)) model. We find that COVID-19 has a negative impact on the performance of companies of the energy industry companies in high-pandemic areas. When goodwill impairment is introduced as a moderating variable, the negative impact is still significant in the goodwill impairment group, while there is an insignificant negative impact on the companies without goodwill impairment.

The marginal contributions of this paper are as follows. First, this paper studies the impact of COVID-19 on energy industry's corporate performance for the first time. Extant studies have investigated the connection between COVID-19 and oil price (Gil-Alana & Monge, 2020; Narayan, 2020) and the impact of COVID-19 on US Partisan conflict index (Apergis & Apergis, 2020). There are few studies on the impact of COVID-19 on corporate performance. In this paper, the economic impact of the pandemic was quantitatively analyzed by the DID model, and the impact on the energy industry was evaluated. Our work provides a motivation and indeed a foundation for future researchers to examine COVID-19 and energy relation from alternative perspectives and/or models. Second, the literature has found the tendency of executives to use M&A to increase their own remuneration, and most of the goodwill fails to bring value enhancement to the enterprise (Harford et al., 2012). Through the introduction of goodwill impairment as a moderating variable, we found that companies with goodwill impairment were more negatively affected by the pandemic and their business performance declined significantly. Thirdly, while country responses and the reaction of the stock market to COVID-19 have been discussed in Narayan and Phan (2020), our analysis is novel in that we examine how COVID-19 influences energy firms performance. We find that pandemics like COVID-19 negatively influence energy companies' performance. Decision makers should respond to the impact of COVID-19 in a timely manner and adjust their strategic decisions so as to mitigate the repercussions of the pandemic and achieve long-term development.

2. Theoretical analysis and research hypothesis

2.1 The impact of COVID-19 on corporate performance in the energy sector

The energy industry is a traditional sector. With the development of science and technology, the energy industry is divided into traditional energy industry and new energy industry. Traditional energy industry refers to developing and

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utilizing various natural energy resources and transforming them into secondary energy. Production includes mining and smelting of coal, oil and natural gas. It also includes energy and power industry chains. Compared to the traditional natural sources, the new energy industry includes the development and utilization of some new sources. It is mainly divided into the following two categories: one is the new energy, such as water energy, wind energy, nuclear energy, solar energy and biomass energy; the other is the new driving force formed by technological innovations. Although there are significant differences in production methods and raw material sources between the traditional energy industry and the new energy industry, both of them are characterized by large investments in fixed assets and therefore carry high fixed costs. According to the real option theory, investors tend to defer investment to deal with the uncertainty when external risks rise. Because of the pandemic (COVID-19), the government has strictly controlled the production, and even factories closed in serious-impact regions, leading to the decline in enterprise income. With the symbol of "high energy consumption" and "heavy assets", the performance of energy industry companies is more likely to fluctuate with changes in the external environment as the energy companies must ensure that the revenue could cover the high fixed costs. Under the double pressure of decreasing revenue and increasing cost, the uncertainty of enterprise operation is greatly enhanced. Therefore, the uncertainties brought by COVID-19 make investors, especially creditors such as banks, more risk-averse. Listed companies will face greater financing constraints, which will lead to tight operational cash flows and declining performances. Based on the above analysis, the first research hypothesis of this paper is proposed:

> H_1: Ceteris paribus, the COVID-19 pandemic has a negative impact on the performance of energy companies in the serious-impact regions.

2.2 Moderating effect of goodwill impairment

Goodwill is a unique accounting asset generated by mergers and acquisitions. The difference will be recognized as goodwill between the higher consideration and the fair value of the target's net assets, which can be reflected in the merged financial statements of the acquirer. The enterprise merger is regarded as a good signal of development because it will promote the company to expand the business category and improve shareholder returns. Managers also benefit from the merger with more compensation. Therefore, there has been a "merger boom" in China since 2014. Overestimation of the net assets of acquired party leads to exaggerate synergies, while there will be "bubbles" in the goodwill. These bubbles will be recognized as goodwill impairments when the performance drops. Compared to other enterprises, companies with goodwill impairment have higher unique risks, and their performance will fluctuate more during the pandemic. To sum up, the second research hypothesis of this paper is proposed as:

> H_2: Ceteris paribus, companies with goodwill impairments will be more vulnerable to the pandemic and their performance will decline significantly.

3. Data and method

In this paper, the financial data of the listed companies in China's energy industry from 2014 to 2020 were selected as the research samples, and the DID model was adopted for regression analysis. In the research design, the following samples were excluded in order to ensure the comparability of research objects: (1) financially distressed companies; (2) banks, securities and other financial companies; and (3) companies with missing data. In order to reduce the impact of extreme values, the data were processed by winsorizing at the 1% and 99% level. All data are from the CSMAR database. Model (1) was employed to test hypothesis H_1:

$$\text{NROA}_{it} = \beta_0 + \beta_1 Treated_i * \text{Period}_{it} + \beta_2 \text{Tre}$$
$$\beta_3 \text{Period}_{it} + \beta_4 \text{SIZE}_{it} + \beta_5 \text{LEV}_{it} + \beta_6 \text{GROWTH}_{it}$$
$$\beta_7 HF10_{it} + \beta_8 \text{TR}_{it} + \Sigma \text{INDUSTRY} + \Sigma \text{YEA}$$

Among them, the dependent variable *NROA* is the return on net profit, which represents the company's performance status. Treated is a dummy variable of "pandemic impact degree", and Period is a dummy variable of the time when the pandemic occurs. According to the number of confirmed cases in all provinces on March 26, 2020, the areas with a cumulative number of confirmed cases of more than 500 people were considered as high-impact areas, and others were considered as low-impact areas. The following provinces and cities were listed as high-impact areas: Hubei, Guangdong, Henan, Zhejiang, Hunan, Anhui, Jiangxi, Shandong, Jiangsu, Chongqing, Sichuan, and Beijing. As for the dummy variable Period, we are convinced that the performance in the first quarter of 2020 should be recognized as affected-period, since the pandemic was an outbreak that resulted in January and February.

In addition, we set up the following control variables to reduce the interference to the study according to the current study on factors affecting corporate performance of existing research. They are: enterprise SIZE (*SIZE*), asset-liability ratio (*LEV*), revenue growth rate (*GROWTH*), the share held by the top-10 shareholders (HF10), trade receivable turnover (TR), control of the industry and the annual fixed effect at the same time. The main variables and related definitions used in the model are shown in Table 1.

4. Empircal Results
4.1 Unit root test and parallel trend test

Before panel regression, all data needs to be tested for unit root test to identify its integration order. The parallel trend test shows that the study samples are in the same trend without the pandemic impacts. All variables have passed the unit root test at the 1% level, and the panel data can be considered stable. In the parallel trend test, the data of high-affected regions and low-affected regions before the pandemic have similar variation trends, which can be further studied by DID modeling. The results are shown in Figure 1.

4.2 Regression results

The empirical results are shown in Table 2. In the first column, all companies in the energy industry are taken as research objects to conduct DID model regression analysis. The coefficient of Treated*Period was -0.0015 and significant at the 5% level, suggesting that COVID-19 had a negative impact on corporate performance in the energy industry. Due to the implementation of shutdown and personnel isolation policy, the high fixed cost of plant and machine equipment could not be covered by the income, which eventually led to a sharp decline in the corporate performance in the energy industry. The research hypothesis H_1 is supported. The second and third columns take the firms without goodwill impairment and others with it as the re-

Table 1 Variables definitions.

Variables	Descriptions
NROA	Net profit margin on total assets, net profit/ending balance on total assets.
Treated	The dummy variable of "outbreak impact degree" is 1 if the enterprise belongs to the high-impact region, otherwise it is 0.
Period	The dummy variable of "outbreak time" is 1 after the outbreak, or 0 otherwise.
SIZE	The size of an enterprise is measured by the logarithm of its total assets.
LEV	The asset-liability ratio is the total liabilities/total assets measure.
GROWTH	Growth rate of operating income, i.e. (current operating income - previous operating income)/previous operating income.
HF10	The Herfindahl index 10, or the share held by the top-10 shareholders.
TR	Trade receivable turnover/1000, trade receivable turnover=revenue/average trade receivable balance.
INDUSTRY	Used to control industry fixed effect.
YEAR	Used to control the fixed effect of year.

This table contains variable description. The first column has the short form of the variable name as used in the empirical analysis while the second column describes each variable.

Table 2: Empirical Results.

	Baseline (1)	GWIM=0 (2)	GWIM=1 (3)
Treated*Period	-0.0015**	-0.0004	-0.0030**
	(-2.0195)	(-0.4436)	(-2.3285)
Treated	0.0015**	0.0013*	0.0016
	(2.2389)	(1.6477)	(1.4958)
Period	-0.0035***	-0.0033***	-0.0023*
	(-5.1195)	(-4.0734)	(-1.8648)
SIZE	0.0018***	0.0019***	0.0018***
	(8.1496)	(7.0132)	(4.9752)
LEV	-0.0219***	-0.0227***	-0.0195***
	(-19.0887)	(-16.2053)	(-10.4813)
HF10	0.0058***	0.0040	0.0112***
	(2.6147)	(1.5012)	(3.0657)
GROWTH	0.0003***	0.0057***	0.0057***
	(2.6585)	(9.1885)	(6.7385)
TR	0.0859***	0.0407	0.0581
	(2.5978)	(1.1442)	(0.5006)
Constant	-0.0305***	-0.0283***	-0.0281***
	(-5.9773)	(-4.7230)	(-3.2154)
IND	YES	YES	YES
YEAR	YES	YES	YES
N	3,927	2,730	1,197
Adj-R^2	0.2780	0.3408	0.4048

This table has regression results on the impact of COVID-19 on energy corporate performance. The results are for the total sample and those grouped by goodwill impairment. Column (1) shows the regression results with total samples. Columns (2) and (3) show the regression results grouped with and without goodwill impairment, respectively. Significance levels at the 10%, 5%, and 1% are denoted by *, **, and ***, respectively.

search samples for regression analysis, respectively. The results show that the corporate performance without goodwill impairment is not significantly affected by the pandemic. When the sample subjects were companies with goodwill impairment, the Treated*Period coefficient was -0.0030 and significant at the 5% level, indicating that the companies with goodwill impairment had higher specific risks and suffered more performance decline during the pandemic. This finding supports hypothesis H_2.

5. Robustness test

In this paper, we choose propensity matching score method and alternative dependent variables for robustness test. The results are consistent with the original research results. First, regression analysis was performed by alternative dependent variables. We measure the level of corporate performance by return on equity. The results are consistent with H_1 and H_2.

Second, all control variables in the model are used as evaluation factors, and corporate samples with the same characteristics are screened by the propensity score method for robustness test. All the results, again, are consistent with H_1 and H_2.

6. Conclusion

This paper studies the performance of energy companies during the outbreak of COVID-19. Our study found that the COVID-19 pandemic had a negative impact on the corporate performance of the energy industry, with the industry performance declining in the first quarter of 2020. COVID-19 hurt productivity in the energy sector, causing companies' revenues to plummet. The companies failed to cover fixed costs and expenses and it resulted in poor corporate performance eventually. We found that the performance of companies with goodwill impairment was negatively affected by COVID-19, which was closely related to the business risks brought by goodwill.

In view of the positive trend of the pandemic, decision makers at all levels should adjust their strategies to prepare for the post-pandemic era. At the macro-economic level, the state needs to provide more policy preferences and subsidies to enterprises in the energy industry, especially those with goodwill impairment, so as to ensure the supply of necessary energy to the residents and businesses. At the firm-level, managers should focus on the impact of fixed expenses on corporate performance and reduce the degree of operating leverage appropriately. At the same time, the
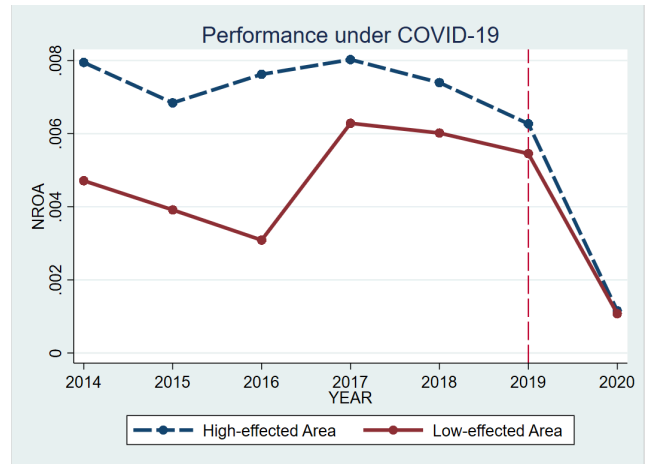
Figure 1 Parallel trend test.

This figure plots parallel trend test which is calculated based on the financial data of China's listed energy companies from 2014 to 2020.

leaders should also pay attention to the risk warning signals provided by goodwill impairment. At the individual-level, investors should consider the performance of energy enterprises during the pandemic to rebalance their portfolios.

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REFERENCES

Apergis, N., & Apergis, E. (2020). Can the COVID-19 pandemic and oil prices drive the US Partisan conflict index. *Energy Research Letters.*

Gil-Alana, L. A., & Monge, M. (2020). Crude oil prices and COVID-19: Persistence of the shock. *Energy Research Letters.* In press.

Harford, J., Humphery-Jenner, M., & Powell, R. (2012). The Sources of Value Destruction in Acquisitions by Entrenched Managers. *Journal of Financial Economics, 106*(2), 247–261. https://doi.org/10.1016/j.jfineco.2012.05.016

Narayan, P. K. (2020). Oil price news and COVID-19-is there any connection? *Energy Research Letters.* In press.

Narayan, P. K., & Phan, D. H. B. (2020). Country responses and the reaction of the stock market to COVID-19-A preliminary exposition. *Emerging Markets Finance and Trade.* In press.