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Does oil price affect the performance of electronic-vehicle companies in China?

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Abstract

This article hypothesizes the impact of oil prices on electric vehicle companies' performance and uses the monthly rate of change in oil prices from 2015 to 2020 and the implementation of 50 leading electric vehicle companies. I found a negative relationship between the oil price change rate and the company's return on assets. It shows that the oil price change rate will have a negative effect on electronic vehicle firm performance. After that, I do the Robustness check by changing return on asset to return on equity and find the same result between oil price change rate and return on equity. The result shows that the oil price change rate will affect the firm performance. It fills the blank for the oil price in electronic vehicle firm performance area. For the electronic vehicle company, manager can refer to oil price change rate to do adjustment. It will convince the electronic vehicle company to manage the firm performance.

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1. Introduction

Electric vehicles have played an essential role in replacing traditional fuel vehicles and solving human air pollution in recent years. China's auto market is the market with the most number of new cars in the world since 2009 (Gong, 2013). In recent years, they have also occupied an increasing share of the Chinese automobile market. In 2020, the sales of new energy vehicles in China will reach 1.367 million, and the penetration rate will increase to 5.4%. The sales of new energy vehicles exceeded 1 million for three consecutive years, ranking first in the world for six straight years, and the stock price of China's new energy vehicle companies also rose accordingly.[1] It is also related to the rise of the taxi industry in China in recent years. With the rise of online car-hailing platforms, many online car-hailing companies led by Didi Chuxing, Shouqi, and Cao Cao have re-emerged on the Internet. The taxi industry in the era has lowered the threshold for taxi drivers, allowing taxis to become a sideline, and more and more people join, making people more sensitive to oil prices. It also shows that fuel prices may become a factor that affects the performance of electric vehicle companies, and managers can even use the trend of fuel prices to predict the performance of electric companies over a while.

As an industry that almost everyone favors, the share price of electric vehicle companies has fallen sharply recently. The lithium battery giant Ningde Times has fallen by 7.5%, and BYD, Ganfeng Lithium, Enjie, Yiwei Lithium, and Putai have fallen by 4.3-8.2%.[2] The performance of

[1] Xinhua News Agency, 2021, Sales exceeded one million for three consecutive years. my country's new energy vehicles are developing strongly,http://www.gov.cn/xinwen/2021-08/26/content_5633571.htm

[2] Reuters Staff, "Stock Market Bulletin" China's new energy automobile stocks plummet, https://www.reuters.com/article/ "Stock Market Bulletin" China's new energy automobile stocks plummet-idCNL4S2PG0FW

electric vehicle companies has also attracted more and more attention. But the company's performance in corporate financial management has a complete 5-factor research system (enterprise size, asset-liability ratio, revenue growth rate, the share held by the top 10 shareholders, free cash flow, and trade receivable turnover). Obviously, from a conventional perspective, It is challenging to get a reasonable explanation. This research analyzes from a new perspective and attempts to find out the impact of oil prices on the performance of electric vehicle companies from a micro perspective to verify that specific commodity prices can affect company performance. Through the analysis of the company performance of all electric vehicle companies in China's A-share sector and the overall company performance of China's electric vehicle industry, the analysis is carried out using China's oil price change rate. Trying to use the huge Chinese market to analyze the company's performance in the overall electric vehicle industry in the world and draw conclusions.

First, I collected and calculated the amount of oil change in China from 2015 to 2020, and used this data to do two multiple linear regression and Bayes linear regression with return on assets of all electric vehicle companies in China's A-share sector, and found that the oil change rate has a negative effect on ROA. After that, I use ROE to substitute the ROA to do multiple linear regression and Bayes regression to proving the result. From the multiple regression the ROE shows the same negative effect with ROA. From the Bayes linear regression, the result also shows the firm performance have negative relationship with Oil price change rate. This proves the conjecture that the rate of change in oil prices and the company's performance of electric vehicle companies change in the opposite direction.

As a brand-new direction, this research can provide a brand-new idea in corporate financial management by analyzing the changes in the price of specific commodities to predict company

performance and fill the gap in the micro-angle analysis of corporate financial management. Predicting the future performance of electric vehicle companies through the rate of change of oil prices will be of great help to the management of companies in the electric vehicle industry.

The other part of the thesis shows here. Part 2 shows the literature review for the previous research in oil price change's effect in financial area and post two hypothesis for this thesis. Part 3 describe the data and the analysis way I use in this thesis. Part 4 shows the main result and regression. Part 5 is the last part which is conclusion for this thesis.

2. Literature Review and Hypothesis Development

As an essential industrial resource, petroleum plays a critical role in the industrial field. Whether it is heavy industry or light industry, fat occupies a significant position. Because of its importance, crude oil is a critical future in the financial field, and its price has attracted many people's attention. Moreover, changes in the financial market caused by changes in its prices have always been an important research direction.

2.1 Oil price will affect the electronic vehicle firm performance

By sorting out the previous articles, that can be concluded that the economic research on oil price changes can be divided into three types: first, the impact on economic indicators, second, the impact on the stock market, and third, on specific companies. (Hamilton, 1983, 2003; Gisser and Goodwin, 1986; Mork, 1989; Bohi, 1989; Rotemberg and Woodford, 1996; Hooker, 1996; Bachmeier, 2008; Lee, et al., 2017), It is due to the impact of changes in oil prices on various economic activities. Bagirov and Mateus studied the effect of oil price changes in the European market on the stock market and company performance and concluded that crude oil prices have a significant positive impact on oil and futures companies listed in Western Europe. It also shows

that oil prices can be used as an essential factor to measure company performance. Although electric vehicles cannot be directly connected with fuel as a substitute for traditional fuel vehicles, the performance of electronic vehicle companies is affected by the impact of oil on the performance of conventional fuel vehicle companies. Since the oil and automobile industries are the relationships between supply and demand, Gogineni (2010) also provides evidence that changes in oil prices impact the performance of companies in the automobile industry, not only on market but also on the cost side. From this perspective, oil prices may significantly affect the performance of companies in the electric vehicle industry.

Hypothesis 1: Changes in oil prices will have a positive impact on the performance of companies in the electric vehicle industry.

2.2 Oil price change will have a negative influence on firm performance

Previous studies on the impact of oil prices on a series of macro variables have shown that the uncertain changes in oil prices will adversely affect some economic macro variables. For example, in terms of changes in total output, unemployment, investment, and stock market performance, unstable changes in oil prices will harm them (Ferderer, 1996; Elder and Serletis, 2010; Kocaaslan, 2019; Diaz et al., 2016). In terms of investment, many studies have shown (Bernanke, 1983; McDonald and Siegel, 1986; Pindyck, 1988; Pindyck, 1991; Dixit and Pindyck, 1994) that when the price of oil is uncertain, people will postpone investment, which will Harm the company's performance. As the price of oil is also a critical production input for electric vehicle companies, the uncertainty of its price will harm the decision-making of electric vehicle companies. As for the impact of oil price fluctuations on company management, Phan et al. (2020) investigated a large sample of American companies and concluded through processing and

analysis that changes in oil prices would negatively affect company performance at the overall market and industry level.

From consumers' perspective, the uncertainty of oil prices may postpone the consumption of durable goods (Elder and Serletis, 2010). The anticipation of oil prices will also interpret the impact on consumers' consumption expenditures. An increase in the savings rate will cause an irreversible delay in the purchase time. Electric vehicles are durable goods. Due to the delay in consumer purchases of durable goods, the sales performance of electric vehicles will also be affected. Sales performance is an essential part of the performance of electric vehicle companies. It can be inferred that consumer delays in purchasing electric vehicles caused by the uncertainty of oil prices will harm the performance of electric vehicles.

Hypothesis 2: Changes in oil prices will have a negative impact on the performance of electric vehicle companies.

3. Data and Methodology

This study uses Bloomberg and Wind Resource Data (WIND) to collect data without survivorship bias. From WIND, I downloaded the rate of change of crude oil prices in the Chinese market for the first quarter of each year from 2015 to 2020, Form Bloomberg; I downloaded the financial data of electric vehicle companies from 2015 to 2020. This sample excluded: (1) companies with financial difficulties. (2) Firms lack data. Here is my return function:

$$ROA = \beta_0 + \beta_1 Opr_{it} + \beta_2 Size + \beta_3 Grwoth + \beta_4 Lev_{it} + \beta_5 Hf10_{it} + \beta_6 Tr_{it} + \beta_7 Fcf_{it} + \varepsilon_{it} \qquad (1)$$

In this sample, I study Return on Equity (*ROE*) as the dependent variable and oil price change rate as the independent variable for regression analysis. If you only rely on the amount of oil price changes for data analysis, other variables will affect the reliability of the regression.

Therefore, asset-liability ratio (*Lev),* and trade receivable turnover (*Tr*), Free cash flow (*Fcf*), as control variables to enhance the reliability of the experiment.

4. Results and discussions

4.1 main result

My regression model is:

$$ROA = \beta_0 + \beta_1 Opr_{it} + \beta_2 Tr + \beta_3 Lev + \beta_4 Fcf_{it} + \varepsilon_{it} \quad (2)$$

After using excel to perform a linear regression analysis to process the changes in oil prices and the performance parameters of the company's performance in each quarter in the past five years, the data obtained shows in Table 3. It can be seen that the P-value of this model is 0.484, and the value of this p-value is much larger than expected, which means that this model has relatively large errors. In the correlation analysis in Table 2, the rate of change of oil price has no significant correlation with the value of ROA. This means that changes in oil prices may not have an impact on the company's performance. On the condition that Lev, Tr and Fcf are used as control variables, the rate of change of oil prices does not have an excellent predictive effect on the company's performance. After that, I use SPSS to do multiple linear regression for it. And the result for the regression between the ROA and Opr have a significant negative relationship. Which proof the Hypothesis 2, which means Opr have a negative effect with electronic vehicle’s firm performance.

4.2 Additional result

After the multiple linear regression for *Oil* price change with *ROA*, I use the control variable with, *Fcf, Tr, and Lev*. Use this function:

$$ROA \sim N(\beta^T Opr, \sigma^2 I) \tag{3}$$

Perform Bayesian regression on the rate of change of oil price and ROA. The results of Bayesian regression show that the rate of change of oil prices has a positive response to ROA. For Bayes regression, it uses a number which form the variables to do regression. It can let the variables have significant relationship with each other.

4.3 Robustness Checks

First, I use return on equity (ROE) instead of ROA for testing. Through the impact of the oil price change rate on ROE, the reliability of the effects of the oil price change rate on ROA is verified. I use Bayes regression for ROE and Opr, because it success show the relationship between ROA and Opr. So, I think the Bayes linear regression will have a good run for the ROE and Opr, the function is:

$$ROE \sim N(\beta^T Opr, \sigma^2 I) \tag{4}$$

Form Table 6 shows the result of ROE regression is not significant, which p-value is 0.403, it means that the ROE doesn't have a substantial relationship with the oil price change rate. It just had little negative relationship with oil price change rate. However, it had the same side with ROA test. So, I use another way to do robustness check, which is the multiple linear regression which have a straight look for the relationship between ROE and Opr. Maybe the sigma number for Bayes linear regression between ROE and Opr, it did not show a significant relationship with each other, so I change to use linear regression for stability testing. It shows that there are not actually same change way between ROE and ROA, so it not have an expected result for ROE's Bayes linear regression with Opr. It could be the ROE and ROA have different factor, so the Bayes linear regression did not calculate a sigma to do regression between ROE and Opr, it let Bayes linear

regression have not shown the significant relationship between ROE and Opr. So, I use multiple regression to find the relationship between ROE and Opr. So, the multiple linear regression Function is:

$$ROE = \beta_0 + \beta_1 Opr_{it} + \beta_2 Tr + \beta_3 Lev + \beta_4 Fcf_{it} + \varepsilon_{it} \quad (5)$$

By performing linear regression and Bayesian regression on ROE, the results are obtained, verifying that the oil price has a negative relationship with Opr, which means that there is actually negative relationship between Chinese electronic vehicle firm performance. But for ROE, it did not have such significant relationship with Opr. Because there are not same calculate way to calculate ROA and ROE, it has different relationship between Opr with ROA and ROE. From Table 7, it shows the ROE have a negative relationship with Opr, but there is not such significant relationship with ROA and Opr. The regression result is enough to proof the relationship between electronic vehicle firm performance and oil price change rate in China. Because there are enough big data base in Chinese A-share market, it can present the electronic vehicle industry firm performance in the world. And this result also shows the different between ROE and ROA in research way. They have different factor, so using Bayes or multiple linear regression may have totally different result for study.

Above all, the regression between ROE and Opr proof the relationship in oil price change rate with electronic vehicle firm performance, and there are less negative relationship for ROE with Opr compare with ROA and Opr.

5. Conclusions

My thesis found the result that the rate of change of oil prices impacts the performance of companies in other industries, and that the rate of change of oil prices has an impact on the performance of companies in the electric vehicle industry. Then I analyzed the company performance of all companies in the A-share electric vehicle sector combined with the rate of change in oil prices. Use each company's ROE and ROA for research. And use all Chinese A-share electronic vehicle company data in 5 years quarterly for research.

By performing linear regression and Bayesian regression on ROA, we can find out the impact of oil price change rate on ROA. After performing linear regression and Bayesian regression, it can be seen in Table 3 and Table 4 that changes in oil prices will harm ROA. This also verifies Hypothesis 2, that the rate of change of oil prices hurts the performance of electric vehicle companies. Through the robustness test and the return to ROE, it is further verified that the rate of change of oil prices has a negative impact on the performance of companies in the Chinese electric vehicle industry. This also shows that the change rate of oil price has a negative impact on the performance of electric vehicle companies. When the market share of China's electric vehicle market is large enough, it can show that the oil price change rate has a significant negative impact on the electric vehicle industry.

This paper fills in the gaps in the impact of changes in specific commodity prices on the company's performance and confirms that changes in oil prices through the impact of supply and demand are negative for performance for electric vehicle companies. As for the research field of oil prices, company performance can also be used as a comparison to research changes in oil prices. This paper confirms the relationship between the two areas and broadens that the amount of change

in related special products may affect the company's performance for a specific field. From the industry's perspective, when oil prices are undergoing substantial changes, attention should be paid to whether the production of products meets the supply and demand relationship so that the company's performance can be better achieve

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Table 1 Descriptive Statistics

This table extracts 60 samples from each variable for simple processing analysis. In this table *Opr* means oil price cange rate,*ROA* means the return of total assets, *SIZE* means size of an enterprise is measured by the logarithm of its total assets, *Growth* means the revenue growth rate, *Lev* means assets liability ratio, *Hf10* means the share hold by top 10 shareholders, *Tr* means the trade receivable turnover rate.

Variables	Number Observations	Mean	StdDev	Min	Max
Opr (%)	60	3.86	32.41	-66.24	109.37
ROA(%)	60	3.51	2.172	0.20	8.56
Size (trillion)	60	1.14	3.76	0.79	2.75
Growth (%)	60	5.68	13.28	-40.26	20.12
Lev (%)	60	1.67	0.02	1.62	1.70
Hf10 (billion)	60	816.3	1.87	707.38	1060.6
Tr (%)	60	5.06	3.71	1.13	13.63

Table 2 Correlations

The table shows the correlations between six variables: *Opr, ROA, Growth, Hf10, Tr* and *Lev*. It shows that *Opr* have sick negative relationship with *ROA* straight, and *Tr* has the most positive relationship with *ROA*. After that, *Tr* also have the most positive relationship with *Opr*, it shows *Tr* have the best correlations with other variables. The t-statistics were reported in the paretheses below the estimated coefficients. *-stat. sign. at 10% level; **-stat. sign. at 5% level; ***-stat. sign. at1 % level.

	Opr	*ROA*	*ROE*	*FCF*	*LEV*	*Liquidty*
Opr	1					
ROA	-0.0668**	1				
ROE	-0.1038***	0.9068***	1			
Fcf	0.0334**	0.0672**	0.0600*	1		
Lev	0.0004	0.0548*	0.0877	0.0330***	1	
Liquidty	0.0717**	-0.1721***	-0.0284	-0.0234	0.1312***	1

Table 3 Main Regression Results

The table shows the main regression result of samples:

$$ROA = \beta_0 + \beta_1 Opr_{it} + \beta_2 Tr + \beta_3 Lev + \beta_4 Fcf_{it} + \varepsilon_{it}$$

In the table, we can see the regression result of the model. It shows the Coefficient, standard deviation, t state, p-value, and the significance test.

	ROA	ROA
Opr	0.00041	-0.00625*
	-0.115	(-0.00309)
Tr		0.637***
		(-0.0389)
Lev		-4.009***
		(-0.02)
Fcf		8.60E- 10
		(-8.94E-10)
constant	27.75***	7.068***
	-3.789	-0.244
N	43	43
adj. R-sq	-0.024	1

Table 4 Bayes linear regression

This table is Bayes linear regression result:

$$ROA \sim N(\beta^T Opr, \sigma^2 I)$$

The table shows that at the 95% level the oil price change rate have significant negative relationship with *ROA*. With the control variable *Growth, HF10, Tr, Lev* and *Fcf*.

		Mean	Std. Dev.	MCSE	Median	Equal-tailed [95% Cred. Interval]	
ROA							
	Opr	-0.00575	1.32E-09	4.10E-10	-0.00575	-0.0115	
	FCF	8.17E-11	4.15E-11	2.10E-12	8.13E-11	2.00e-12	1.66e-10
	Lev	-5.29436	9.37E-10	2.80E-10	-5.29436	-10.589	
	Tr	0.025454	1.26E-09	3.80E-10	0.025454	.0254543	.0254543
	constant	7.359211	5.73E-10	1.70E-10	7.359211	7.359211	7.359211
	sigma2	25.95818	1.191538	0.024373	25.93864	23.62954	28.45782

Table 5 Multiple linear regression

This regression use the significant control variable in table 4 to do regression between ROA and oil price change rate.

$$ROA_{it} = \beta_0 + \beta_1 Opr_{it} + \beta_2 Growth_{it} + \beta_3 Tr_{it} + \varepsilon_{it}$$

	ROA	ROA	ROA	ROA
Opr	-0.00575	-0.00683*	-0.00575	-0.00575
FCF		8.31e-11**	8.31e-11**	8.31e-11**
Tr	0.0255		0.0255	0.0255
Lev	-5.294***		-5.294***	-5.294***
constant	7.359***	5.035***	7.359***	7.359***
N	944	944	944	944
adj. R-sq	0.038	0.003	0.038	0.038

Table 6 Robustness Checks

This table use ROE to do regression. The function is:

$$ROE \sim N(\beta^T Opr, \sigma^2 I)$$

The table shows that at the 95% level the oil price change rate have significant negative relationship with *ROE*. With the control variable *Growth, HF10, Tr, Lev* and *Fcf*.

		Mean	Std. Dev.	MCSE	Median	Equal-tailed [95% Cred. Interval]	
ROE							
	Opr	-0.01768	1.41E-09	4.20E-10	-0.01768	-0.0354	
	FCF	1.35E-10	7.04E-11	3.40E-12	1.36E-10	-4.96e-12	2.70e-10
	Lev	-1.57553	1.40E-09	4.10E-10	-1.57553	-3.1511	
	Tr	0.050312	1.88E-09	5.80E-10	0.050312	.0503118	.0503118
	constant	7.973987	1.11E-09	3.30E-10	7.973987	7.973987	7.973987
	sigma2	73.76491	3.415444	0.073365	73.67631	67.35017	80.57865

Table 7 Robustness check

This table use ROE with control variable to do multiple linear regression, the function is:

$$ROE_{it} = \beta_0 + \beta_1 Opr_{it} + \beta_2 Growth_{it} + \beta_3 Lev_{it} + \varepsilon_{it}$$

The regression uses the significant control variable, which wants to get a lower p-value, but it still cannot get a substantial answer for the *ROE* between *Opr*.

	ROE	ROE	ROE
Opr	-0.0177*	-0.0177*	-0.0177*
	(-0.00892)	(-0.0089)	(-0.0087)
FCF			1.33e-10*
			(-6.53E-11)
Tr			0.0503
			(-0.0373)
Lev			-1.576
			(-1.647)
constant	7.527***	7.527***	7.974***
	(-0.276)	(-0.276)	(-0.776)
N	944	944	944
adj. R-sq	0.01	0.01	0.019