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How Does Market Share Impacted Oil Oligopoly Firms' Profits Volatility Under the Price Shock?

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Abstract: This paper aimed to identify how the oligopoly firms' market shares related to the profit stand ability. I selected firms from oil industry, which is widely recognized as oligopoly market, as an example and see if higher market share will stabilized firms profits in the face of oil price shock in 2020, caused by both global pandemic Russia–Saudi Arabia oil price war. I found that in the long-run, the firm's market share is negatively correlated with firms' profit volatilities. However, large firms' profits fluctuates more in this price shock compared to small firms' profits. Reasons might be small firms from my samples are more from OPEC countries which are less impacted by this price shock. Also, the price shock prices brought more business uncertainties for big oil companies than for small ones in both stock prices and other factors. This account for higher profit fluctuation for the large oil firms.

Keywords: Oligopoly; Market Share; Oil Industry; Profitability

1. Introduction

In 2020, the outbreak of COVID-19 crushed the global economy. Due to the economy shut down and limited capacity, oil consumption has plummeted dramatically as a primary manufacturing material and transportation fuel. Facing of a demand shock, Saudi Arabia and Russia, two leading oil-producing countries, reached an agreement that increased oil supply to ease the pressure from the decrease in oil demand in March. They agreed to increase oil production output to 1.5 million barrels per day until June 20, 2020. Sharply increasing oil supply and decreasing in oil demand resulted in the exponential decrease in the global oil price at the end of March.

The significant decrease in oil prices globally also shrinks the profits of oil firms. In this paper, I want to further examine whether price shock impaction to the firms' profits will be correlated with firms' market shares. Theoretically, firms' market shares indicate the equilibrium firms' market share in the market (Caves & Porter, 1978). On the one hand, a large market share implies strong competence in the market. In response to the global oil price shock, firms with higher market shares might help them maintain the market competitiveness. They can also maintain profits by changing their outputs strategies. However, on the other hand, larger market share also meansa more substantial business scale. Those big firms may suffer more substantial losses of margin in the face of price decreases. Therefore, I aim to find out whether firms with higher markets share have better abilities to lock in profits under this global oil price shock. I generated two OLS models to compare the volatility of firms' profits before and after the price shock. I will examine how the firms' market share will impact the volatility of profit in the face of market shock.

2. Literature Review

Referring to previous studies, the correlations in terms of market shares and profits are various. This depends on the different types of markets as well as their structures. Sato (2021) suggested that higher market share does not imply high profit, especially in the more complicated demand systems. Some researchers claimed that high market share will results lower profits. Belleflamme et al. (2022) found that larger scale firms sometimes bear higher price-cost margins ratio

compared to the small firms. This leads higher markets share firms to earn lower profits. However, some evidences show that market power is positively related to profits. Market power is able to influence the oil market including the price of oil as well as aggregate macroeconomic results (Asker et al., 2019). Larger companies have a better ability to lock in profit. In particular, the leading firms in the market show greater stability in terms of profits (Caves & Porter, 1978).

The impact of this price war was greater than any other price shock in history. The research suggested that this price shock even changed the oil market structure as well as the pricing system (Fatthouh & Imsirovic, 2020). Specifically, the low price put huge downward pressure on the oil producers facing a steep decrease in oil price as well as oil demand (Ma et al., 2021). Nevertheless, the researches above only determine that the oil firms in the market were largely impacted by this shock. It still needs to be verified whether higher market shares can reduce losses in this price war.

3. Empirical Research Method and Data Summary

In order to determine whether firms with a higher market share will contribute to oil companies maintaining profitability during oil price shocks. I selected the main oil companies in the six leading oil producing countries: the United States, Russia, Canada, China, United Arab Emirates and Saudi Arabia with 23 leading firms in their oil industries. I summarized their quarterly financial reports and collected 478 observations in total. To see if a high market share mitigates the price volatility risk for a firm in this price shock, I compared the variances of firms' profits (shown in the net income in financial statement) in this price shock. The numerical market share of each firm, the definition of market shares is shown below:

$$Market\ Share = \frac{Firm\ Gross\ Sales}{Domestic\ Oil\ Industry\ Revenue} \quad (1)$$

I would define the firm as high market share firm when the market shares is greater than 15%, and a low share firm otherwise. Considering that some oil firms are running cross-border businesses, it is possible that their market shares are greater than 100%. As a first step in analyzing the relationship between the market share and the change in profit under this price shock, I generated a first order OLS to see if being high market share is negatively correlated with the change rate of profit in the long run:

$$\ln(\sigma_{it}^2) = \beta_1 \ln\left(\frac{p_{it}}{p_{i(t+1)}}\right) + \beta_2 Hi + \beta_3 Xi + \varepsilon \quad (2)$$

The $\ln \sigma_{it}^2$ (stands) for the logarithm of firm i 's profit variances at time t. Since oil prices are hard to obtain, I selected one representative crude future prices index for each country. I would use the logarithm ratio of crude oil future prices at price index i at time $t-1$ and t to estimate the change in crude oil price. The future price index table that I have selected for each country is shown below:

Country	Name of future price Index
United States	WTI Crude
Russia	ESPO
Canada	Canadian Crude index
China	Daqing
United Arab Emirates	Dubai Crude Oil
Saudi Arabia	Arab Extra Light

Table.1 Future Crude Oil Index

Hi is the dummy variable and Hi equals to one when the firm has high market share and zero otherwise. Xi represents a series of controlled variables in this regression. In specific, it includes the firms' quarterly cost ratios and a dummy variable OPEC. The OPEC would be equal to one when the country is a OPEC member. I summarized the data when the market share is high and low and the data summary table is shown below:

Variables ($Hi = 1$)	Obs	Mean	St.d	Min	Max
$\ln(\sigma_{it}^2)$	301	13.66564	4.148412	1.504077	24.48463
$\ln\left(\frac{p_{it}}{p_{i(t+1)}}\right)$	301	.0272936	.2028757	-.970108	.471631
OPEC	301	.1760797	.3815223	0	1
Cost Ratio	301	.9789382	1.241953	.0243604	4.957199

Variables($Hi = 0$)	Obs	Mean	St.d	Min	Max
$\ln(\sigma_{it}{}^2)$	177	13.14824	5.792429	-.6931472	26.74991
$\ln\left(\frac{p_{it}}{p_{i(t+1)}}\right)$	177	86.72976	4.082769	76.92951	96.3
OPEC	177	.3672316	.4834179	0	1
Cost Ratio	177	.0323764	.0299287	.0005359	.1850652

Table 2. the variable summary of the firms with high market share

Note that the results are driven from Stata

According to the data above, the firms with high market shares have a slightly higher mean of profit volatility compared to the low market share firms. However, the low market share firms have a wider profit variance range than the high market share firms from -0.69 to 26.75. Thus, whether high market shares will reduce profit volatility remains to be seen. Comparing the cost ratios factor, high market shares firms have much higher cost ratios than those for firms with low market shares with 90% and 3% respectively. I also included the dummy variable OPEC in my data summary. Compare the average of low market share and high market share firms in OPEC terms. Firms with low market shares are more likely from OPEC in terms of my samples.

However, the first OLS can only infer the correlation between the change in market share and the change in firms' profits over time. I generated my second OLS regression to better examine how the 2020 price shock affects the firm's profit variability with different market shares. My second OLS regression line is shown below:

$$\ln(\sigma_{it}^2) = \beta_1 \ln\left(\frac{p_t}{p_{t+1}}\right) + \beta_2[\ln(\frac{p_t}{p_{t+1}}) \times Post] + \beta_3 Hi + \beta_4 Xi. + \varepsilon \quad (3)$$

On my second regression line, I introduced a new time dummy variable Post, constructing the new cross-session term on my second regression line. Post will be zero before the time shock and one after the oil price shock. Other variables will be the same as the first OLS regression line above.

4. Empirical Result

The first OLS regression line is shown below in Table 3. For the first OLS tables results, having high market shares decreases the logarithm value of profit variance by -1.06. It is proved that a high market share is able to decrease the volatility of firms' profits at a 10% significance level. The result was also explained theoretically in another paper. Amiti et al. (2019) argued that some small firms are lacking strategic complementarities in price setting and cost passing through. Meanwhile, I have found that the cost ratio is positively correlated with firms' profit volatility, when the firms' cost ratio increases by 1%, the logarithm of profits variance increases roughly 0.9%. Meanwhile, being OPCE members also decreases profit volatility. Specifically, it will reduce the logarithm value of profit variance by 3.8. This may be due to a stronger connection between OPEC countries than non-OPEC countries (Rousan et al., 2014). They are able to adjust the oil price through oligopoly strategies such as collusion, which allows them to keep a tight grip on their profits.

Variables	OLS	
	model 1	model 2
$\ln\left(\frac{p_t}{p_{t+1}}\right)$	-1.284057	10.56645
	(.9781859)	(4.557001)**
Hi	-1.063772	-1.047391
	(.4642503) **	(.4634026)***
Cost Ratio	.9174297	.9433908
	(.2082837)***	(.2084116)***
OPEC	-3.812585	-3.760583
	(.4855337)***	(.4854951)***
$\ln\left(\frac{p_t}{p_{t+1}}\right) \times Post$		3.354504
		(1.95956)*
_cons	14.54531	14.50963
	(.3774095)***	(.3772164)***
N	478	478
R^2	0.1724	0.1755

Table 3. OLS regression results

*Note that the data above is generated by Stata. ( ) includes the t statistical value; *, **, *** represent the significance level of 10%, 5% and 1% respectively.*

In terms of the second OLS regression line, it specifies the result of the price shock. For the second regression results, the logarithm value of the future ratio

$\ln\left(\frac{p_t}{p_{t+1}}\right)$ also plays an essential role in changing the logarithm value of profit variance. When it increases by 1%, $\ln(\sigma_{it}^2)$ is expected to increase 10.57% of the logarithm value of the profit variance. Interestingly, large firms got largely affected by this price shock. The cross-section results shows this price shock effect corresponds to 3.35 to the logarithm value of profit volatility. This means that this price shock brings larger profit uncertainty to large firms.

5. Conclusion and Implication

My ultimate goal was to determine if a higher market share would lead to stable profits for the firms. To better examine this topic, I took advantages of the international oil price shock at the beginning of 2020. I aimed to find out how the firms' profits change corresponding to high and low market shares. As a result, first OLS models show that high market shares will stabilize the firms' profits in the long run. However, in this price shock, the firms with higher market shares got impacted more than small firms. I made three implications to the results: firstly, recall that the small firms' data summary is listed above. My sample contains more small firms from OPEC countries, and these firms have more stability in their profit variance values. This might explain the reason why large firms were more impacted by this price shock. Secondly, Yoon et al.(2002) found that the oil price shock impacted more on the capitalized stock of large firms compared to small firms. As a result, the large firms' sources of financing will fluctuate as well as firms' sources of financing cash flows. This might

negatively affect the firm's daily operations and investment projects even impact the firms' profitability. Finally, the many firms with higher market shares are running cross-border and international businesses. These firms also face higher uncertainties in the international oil market as a result of the oil price shock. For example, Fratzscher et al.(2014) found that a increase in the price of oil results depreciation of the US dollar, while a weakening of the US dollar causes oil prices to rise. Therefore, the oil price shock will lead to the exchange rate fluctuating and this will influence large firms' incomes from different countries. This also might increase final profit volatility of large firms.

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Note: Due to the limitation of space, the data not shown in the article are from relevant websites, if necessary, please contact the author directly.